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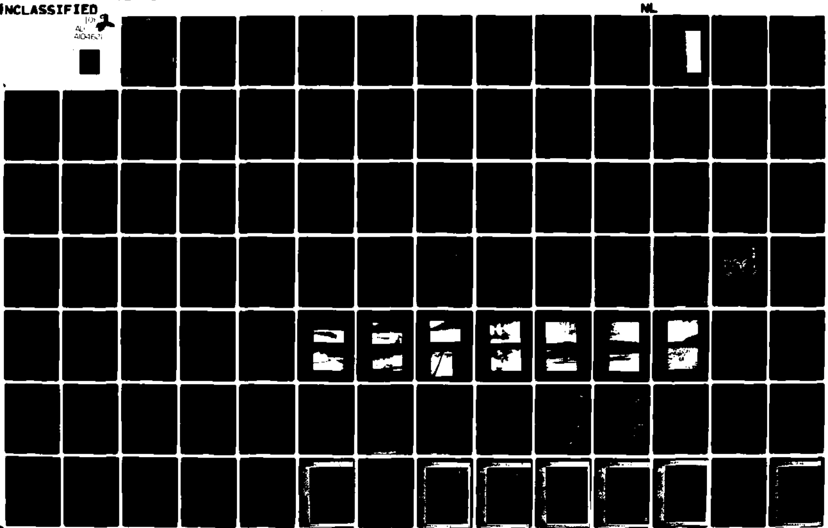

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MISSOURI · KANSAS CITY RIVER BASIN

PERRY PHILIPS DAM
BOONE COUNTY, MISSOURI
MO. 10019

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER, 1980

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A104	3. RECIPIENT'S CATALOG NUMBER 621
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Perry Phillips Dam (MO 10019) Boone County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

SUBJECT: Perry Philips Dam (Mo. 10019) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Perry Philips Dam (Mo. 10019).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED — 09 OCT 1980
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 10 OCT 1980
Colonel, CE, District Engineer — Date

PERRY PHILIPS DAM

BOONE COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10019

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Perry Philips Dam (~~Inventory Number~~ MO-10019)
Missouri-Kansas City River Basin.
Boone County, Missouri. Phase I Inspection
Report.

PREPARED BY

CONSOER, TOWNSEND AND ASSOCIATES, LTD.

~~ST.~~ LOUIS, MISSOURI

AND

PRC ENGINEERING CONSULTANTS, INC.

ENGLEWOOD, COLORADO

A JOINT VENTURE

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

SEP~~TEMBER 1~~980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Perry Philips Dam, Missouri Inv. No. 10019
State Located:	Missouri
County Located:	Boone
Stream:	An unnamed tributary of the Clear Creek
Date of Inspection:	June 3, 1980

Assessment of General Condition

Perry Philips Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. and PRC Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri according to the U. S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property damage could occur in the event of failure of the dam. Within the estimated damage zone of six miles downstream of the dam are three dwellings, one building, and three sheds, all of which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Perry Philips Dam is in the intermediate size classification since it is less than 100 feet but greater than 40 feet in height.

Our inspection and evaluation indicate that the reservoir/spillway system of Perry Phlips Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Perry Philips Dam being an intermediate size dam with a high hazard potential is required by the guidelines to be able to pass the

Probable Maximum Flood (PMF) without dathout overtopping the dam. Therefore, the appropriate spillway design flood for Perry Philips Dam is considered to be the PMF. It was determined that the reservoir/spillway system can accommodate approximately 12 percent of the Probable Maximum Flood before overtopping of the dam occurs. Our evaluation also indicates that the reservoir/spillway system will not accommodate the one-percent chance flood (100-year flood) without overtopping the dam.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Perry Philips Dam and its appurtenant structures are in satisfactory condition. However, some deficiencies were noted by the inspection team which could affect the safety of the dam and appurtenant structures. These items are as follows: the possible seepage downstream of the toe, the trees on the downstream slope, the erosion due to wave action on the upstream slope, the accumulation of moss and other debris on the crest of the service spillway, the rutting in the emergency spillway, a need for periodic inspection by a qualified engineer and a lack of a maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take immediate action to correct the major inadequacy of the reservoir/spillway system to pass the Probable Maximum Flood. Remedial measures should also be taken to correct or control the other deficiencies described above in the near future.

Walter G. Shifrin, P.E.

STATE OF MISSOURI
WALTER
G SHIFRIN
NUMBER
E-8834
REGISTERED PROFESSIONAL ENGINEER

Overview of Perry Philips Dam

NATIONAL DAM SAFETY PROGRAM

PERRY PHILIPS DAM, I.D. No. 10019

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PERRY PHILIPS DAM, Missouri Inv. No. 10019

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Perry Philips Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., and PRC Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Perry Philips Dam was made on June 3, 1980. The purpose of the inspection was to make a general assessment regarding the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, provides a summary of visual observations made during the field inspection, gives an assessment of hydrologic and hydraulic conditions at the site, presents an evaluation of the

structural adequacy of the various project features and appraises the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to the left or right abutments is viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the south abutment or side, and right to the north abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Engineer Regulation No. 1110-2-106" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based exclusively upon observations and measurements made during the visual inspection and from conversations with Mr. Perry Philips, the owner. One design drawing was located and is included in this report (see Plate 4). Any discrepancies between our field notes and the design drawing are noted in Section 2.1 in this report. No major discrepancies were observed.

The dam is a homogeneous, rolled, earthfill structure between earthen abutments, and consists of two straight portions angled at approximately 35° to each other. Photos 1 through 5 show views of the embankment. The major portion of the embankment has a bearing of approximately N 10° E and an axis length of 595 feet between the emergency spillway and the point of intersection of the two axes. The other portion has a bearing of approximately N 45° E and an axis length of 340 feet between the point of intersection of the two axes and the right abutment. The top of dam has a width of 15 feet and a total length of 935 feet between the emergency spillway and the right abutment. The top of dam slopes upward from the emergency spillway to the point of intersection of the two axes with a total elevation gain of approximately 2.4 feet; from this point of intersection to the right abutment it drops 0.8 feet in elevation (see Plate 2). The minimum elevation of the top of dam is approximately 771 feet above mean sea level (M.S.L.). The maximum structural height of the dam was measured to be approximately 44 feet. The upstream slope above the water surface varies from 1 vertical to 3 horizontal (1V to 3H) to near vertical. The downstream slope was measured as 1V to 2.25H. A 15-foot wide and 12- to 15-feet deep core trench was to be excavated into bedrock, parallel to the dam axis, according to the design drawing. Mr. Philips stated that the core trench was indeed constructed.

The double spillway system is located within the left section of the embankment. The emergency spillway is cut into the embankment at the left abutment and the service spillway is 295 feet to the right of the emergency spillway.

The service spillway consists of a 12-inch welded steel pipe laid perpendicularly through the embankment. The pipe is set on a 25 percent grade and is 145 feet in length, according to field measurements; it connects to an approximately 2-foot high, 21-inch diameter steel standpipe at the inlet end. The system functions as a drop inlet (see Photo 6). It is of Soil Conservation Service design and, according to the drawing given to the inspection team,

the design includes three 5-foot square collars welded to the pipe. A steel plate about 10 feet in length and one foot wide is welded vertically across the inlet pipe in order to act as an anti-vortex device (see Photos 6 and 7). The service spillway crest elevation is assumed to be 769 feet above M.S.L.

The emergency spillway control section is cut as a trapezoidal area into the left side of the dam at the left abutment and functions as an open channel (see Photo 10); according to field measurements, the top width is 64 feet, the bottom width is 36 feet, and the side slopes vary between 1V to 5H and 1V to 12H. The elevation of the crest is 769.75 feet above M.S.L. placing it 9 inches above the crest of the service spillway and 2.65 feet below the top of dam at the maximum section. When the water spills over the emergency spillway crest, it flows over a 46 foot long flat area, including a gravel road, and then spreads out into a type of sheet flow on an approximately 3 percent grade before eventually finding its way to the downstream channel (see Photo 11).

No low level drains or outlet works were provided for this dam.

b. Location

Perry Philips Dam is located in Boone County of the State of Missouri on an unnamed tributary of Clear Creek. The dam is located approximately 4.5 miles southeast of Columbia. There are no downstream communities. The dam is located in the southeast portion of Section 32 of Range 12 West, Township 48 North as shown on the Columbia, Missouri Quadrangle (7.5 minute series) sheet.

c. Size Classification

Perry Philips Dam impounds less than 1000 acre-feet and more than 50 acre-feet which classifies it as a "small" size dam. However, the maximum structural height of the dam is less than 100 feet but greater than 40 feet which classifies it as an "intermediate" size dam. The size classification is determined by either the storage or the height, whichever option gives the larger size category. Therefore, the size classification is determined to fall within the "intermediate" category, according to the "Engineer Regulation No. 1110-2-106, Appendix D" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. From a visual inspection of the downstream area, our findings concur with this classification. There are three dwellings, one building and three sheds within the estimated damage zone, which extends approximately six miles downstream of the dam (see Photos 13 and 14).

e. Ownership

Perry Philips Dam is privately owned by Mr. Perry Philips. His mailing address is as follows: Mr. Perry Philips, Box 978, Columbia, Missouri 65205.

f. Purpose of Dam

Perry Philips Dam was constructed to impound water for recreational use.

g. Design and Construction History

According to the present owner, Mr. Perry Philips, the dam was designed by Bernard G. Browning of the Soil Conservation Service in 1962. One design drawing was made available from the Soil Conservation Service and is included as part of this report.

According to Mr. Philips, the dam was constructed by Twehous Excavation Co. of Jefferson City, Missouri.

h. Normal Operational Procedures

Normal procedure for the Perry Philips Dam is to allow the reservoir to remain as full as possible while the water level is controlled by rainfall, runoff, evaporation and the elevation of the service spillway crest.

1.3 Pertinent Data

a. Drainage Area (square miles): 0.55

b. Discharge at Damsite

Estimated experienced maximum flood (cfs):	Unknown
Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs):	149

c. Elevation (Feet above MSL)

Top of dam (minimum):	771.0
Spillway crest:	
Service Spillway	769.0 (Assumed)
Emergency Spillway	769.75
Normal Pool:	769.0
Maximum Experienced Pool:	>769.75
Observed Pool:	769.0

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):	2300

e. Storage (Acre-Feet)

Top of dam (minimum):	437
Spillway crest:	
Service Spillway	366
Emergency Spillway	394
Normal Pool:	366
Maximum Experienced Pool:	Unknown
Observed Pool:	366

f. Reservoir Surfaces (Acres)

Top of dam (minimum):	39
Spillway crest:	
Service Spillway	31

Emergency Spillway	35
Normal Pool:	31
Maximum Experienced Pool:.	Unknown
Observed Pool:	31

g. Dam

Type:	Rolled, Earthfill
Length:.	935 feet
Structural Height:	44 feet
Hydraulic Height:	44 feet
Top width:	15 feet
Side slopes:	
Downstream	1V to 2.25H (measured)
Upstream	1V to 3H to near vertical (measured, above water surface)
Zoning:	Homogeneous
Impervious core:	NA
Cutoff:	A core trench with 15-foot bottom width and side slopes of 1H to 1V. Excavated to bedrock. (According to design drawing).
Grout curtain:	No
Freeboard above normal reservoir level:	2 feet (minimum)
Volume:	59,497 cu.yds. (from design drawing)

h. Diversion and Regulating Tunnel. . . . None

i. Spillway

Type:	
Service Spillway	Drop inlet, uncontrolled
Emergency Spillway	Earthcut channel, uncontrolled
Length of crest:	
Service Spillway	5.5 feet, (21-inch diameter standpipe)

Emergency Spillway . . . . 36.0 feet

Crest Elevation (feet above MSL):

Service Spillway 769.0

Emergency Spillway 769.75

j. Regulating Outlets . . . . None

SECTION 2: ENGINEERING DATA

2.1 Design

One design drawing was made available for use in this report (see Plate 4). The Soil Conservation Service supplied the drawing and was also responsible for the design of the dam and appurtenant structures. The drawing was dated September 21, 1962 and revisions were made to the drawing in August of 1963.

According to the design drawing, the downstream slope was 1V to 2H, and the service spillway conduit was 138 feet; however, field measurements resulted in a downstream slope of 1V to 2.25H and a spillway conduit length of 145 feet. The design also utilized a hooded pipe structure instead of a drop inlet structure.

2.2 Construction

No data are available concerning the construction of the dam and appurtenant structures, other than the design drawing, and the information obtained from Mr. Philips.

According to Mr. Philips, the compaction of the embankment was achieved by the activity of the earthmoving equipment across the embankment. No compaction control was employed. A core trench was excavated to bedrock (limestone) parallel to the dam axis; this corresponds to what is shown on the design drawing. The trench has a bottom width of 15 feet and side slopes of 1V to 1H, as shown on the design drawing.

2.3 Operation

No operational data are available for Perry Philips Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is somewhat lacking and consists of only one design drawing, a Soil Survey for Boone County published by the Soil Conservation Service, State Geological Maps, and U.S.G.S. quadrangle sheets. No information was available on construction or operation of the dam, other than the information obtained from Mr. Philips.

b. Adequacy

The available engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, past performance and present condition of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is con idered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

The only valid engineering data is the one design drawing obtained from the Soil Conservation Service. From field measurements, the dam appears to have been basically constructed according to the available design drawing with only minor discrepancies which are noted in Section 2.1. The only discrepancy that might have some

effect on the safety of the dam and appurtenant structures would be the use of the drop inlet structure instead of the hooded pipe structure. This appears to have changed the design freeboard from 3.1 feet to a minimum of approximately 2 feet.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Perry Philips Dam was made on June 3, 1980. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Project Engineer, Soils and Mechanical
Jerry Kenny	PRC Engineering Consultants, Inc.	Hydraulics and Hydrology
Kenneth Bullard, P.E.	PRC Engineering Consultants, Inc.	Hydraulics and Hydrology
Robert McLaughlin, P.E.	PRC Engineering Consultants, Inc.	Civil
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Perry Philips	Owner	

Specific observations are discussed below.

b. Dam

The overall condition of the dam appears to be satisfactory. However, some items of concern were observed and are described below.

The top of dam supports a gravel access road (see Photos 2 and 3). No tire ruts or depressions, which are sometimes associated with vehicular traffic across earthen structures were observed. The difference in elevation along the top of dam did not appear to be due to an instability of the embankment. According to the design drawing, an additional layer of soil, up to 4 feet thick, was placed on the top of dam in order to allow for settlement of the embankment and foundation materials. Therefore, the difference in elevation is possibly due to the nonoccurrence of the anticipated settlement in the embankment and foundation. No depressions indicating a localized settlement of the embankment were observed. No cracks or misalignment, other than the change in the alignment as originally constructed, in either the vertical or horizontal directions were apparent. According to Mr. Philips, the dam has never been overtopped and no evidence indicating the contrary was observed.

Dumped riprap was seen on the upstream slope in some areas, however, the slope does not appear to be adequately protected against wave erosion. The upstream slope has undergone some erosion due to wave action. Erosional scarps due to wave action were observed along the slope extending from the water surface to approximately the top of dam in some areas. According to Mr. Philips, canary reed grass was planted along the shoreline recently to try to prevent further erosion of the slope. The slope appeared to be adequately protected against surface runoff by a heavy, unmaintained grass cover. No depressions, bulges or cracks indicative of major slope or foundation movement were observed.

The downstream slope is adequately protected against surface runoff by a tall, unmaintained grass cover. No major surface erosion was observed. Several large trees were observed growing on the slope. One area of possible seepage was observed near the bend in the embankment starting at the toe of the slope and extending downstream of the toe. Moist boggy ground, standing water and cattails were observed in the area of possible seepage. The biggest portion of the area is located approximately 60 feet downstream of the toe and is approximately 120 feet long and 50 feet wide (see Photo 5). No measurable seepage was observed. No bulges, depressions or cracks indicative of major slope or foundation movement were observed. A comprehensive inspection of the slope, however, was hampered due to the tall grass cover.

Both abutments are at approximately the same elevation as the average top of dam. Both abutments appear to be adequately protected against erosion. No instabilities or seepage areas were observed on either abutment.

No evidence of burrowing animals was observed on either of the abutments or the embankment. According to Mr. Philips, they have had muskrat problems in the reservoir in the past, however, the muskrats are trapped during the winter months when present.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of Clear Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The topography at the damsite is rolling with V- to U-shaped valleys. Elevation ranges from 760 feet above M.S.L. at the damsite to 800 feet nearly 0.25 miles south of the damsite. The reservoir slopes are generally between 5° and 10° from the horizontal. The area near the damsite is covered with slope wash deposits of glacial-fluvial and loess origins consisting of yellowish brown clayey silt.

The regional bedrock geology beneath the glacial outwash deposits in the damsite area, as shown on Geologic Map of Missouri (1979) (see Plate 5), consists of Pennsylvanian age undifferentiated rocks, Pennsylvanian Marmaton-Cherokee Group rocks (cyclic deposits of shale, limestone, and sandstone), Mississippian age Burlington Limestone (cherty, grayish brown, sandy limestone), Devonian age rocks of the Sulphur Spring Group (Glen Park Limestone and Grassy Creek Shale), and Ordovician age rocks consisting of St. Peter Sandstone and Powell Dolomite. The predominent bedrock near the site vicinity underlying the glacial-fluvial deposits are the Pennsylvanian Marmaton-Cherokee Group, and the Mississippian Burlington Limestone. Inlet and outlet areas of the unnamed tributary of Clear Creek contain Quaternary alluvium. No outcropping of bedrock was seen at the site.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the Fox Hollow Fault nearly 10 miles south of the damsite. The Fox Hollow Fault had its last movement in post-Mississippian time. Thus, the fault has no effect on the dam.

Perry Philips Dam consists of a homogeneous, earthfill embankment, a drop inlet service spillway with a metallic outlet pipe located at the maximum section of the embankment and the emergency spillway located near the left abutment.

Based on the design drawing from the Soil Conservation Service, and conversations with the owner, Mr. Perry Philips, the embankment rests on the gla·ial-fluvial deposits with a core trench excavated to the Burlington Limestone bedrock. According to the boring logs on the design drawing, the limestone bedrock was encountered at depths of 5 to 10 feet below the top of overlying glacial-fluvial deposit. The service spillway metallic outlet pipe and the drop inlet structure rest on compacted embankment fill (dark brown, fine, sandy silt to brown, clayey silt). The emergency spillway was cut into the compacted embankment fill.

(2) Project Soils

According to the "Soil Survey for Boone County, Missouri" published by the Soil Conservation Service in 1962, the common soils in the general area of the dam belong to the Thin Loess Timber:Weldon-Union association. From the Boone County soil maps, the soils at the damsite consist of the Lindley loam and clay loam, the Sharon silt loam and the Union silt loam, and silty clay loam. These soils are basically formed from glacial till, alluvium, and weathered rock. The Lindley soil is generally quite susceptible to erosion. If the Lindley soil type was used in the embankment, the potential of failure of the embankment would be increased due to erosion during overtopping.

Materials removed from the embankment appeared to be a light brown, clayey silt with traces of fine to medium sand. Based upon the Unified Soil Classification System, the soil would probably be classified as an ML. This is an impervious soil type which generally has the following characteristics: a coefficient of permeability less than 50 feet per year; medium to low shear strength, and intermediate to low resistance to piping.

d. Appurtenant Structures

(1) Service Spillway

There is much floating moss and organic debris which floats toward the shoreline (see Photo 7) where it gathers; as it does so, it also gathers around the inlet standpipe and the metal posts in the vicinity (see Photo 6). Since there is not a trashrack included in the inlet system, the moss, weeds, etc., begin to grow and hang over the crest of the standpipe. The pipe does not appear to have a protective coating; also, the anti-vortex device has no protective coating and is presently rusting. The entire outlet opening of the conduit was underwater on the day of the inspecion (see Photo 8).

(2) Emergency Spillway

The crest of the emergency spillway is well protected with a grass cover and an apparently well compacted gravel road. The discharge area is also well protected with a grass cover (see Photos 10 and 11). The approach channel area of the open channel crest has some rutting and the grass cover in general is somewhat sparse. The ruts appear to be from vehicular wheels and were filled with water on the day of inspection, although the ruts were somewhat above the reservoir water level. Although the emergency spillway has been used by excess reservoir flows on a few occasions in the past, it appears that no damage has been sustained.

(3) Outlet Works

There were no regulated outlet works or low level drain pipes constructed for this dam.

e. Reservoir Area

The reservoir water surface elevation at the time of the inspection was 769 feet above M.S.L.

The surface area of the reservoir at normal water level is about 31 acres. The rim seems to be stable. Considerable erosion due to wave action was observed along the rim, however, the erosion does not jeopardize the safety of the dam or appurtenant structures. The land around the reservoir slopes gently to the rim and is grass and/or tree covered. There are no homes built in close proximity to the reservoir (see Photo 12).

f. Downstream Channel

The downstream channel near the dam is undefined and obstructed with trees and bushes (see Photo 9).

3.2 Evaluation

The visual inspection uncovered nothing of a consequential nature which would require immediate remedial action. However, some conditions were observed which could adversely affect the dam in the future and these should be corrected within a reasonable period of time.

1. The possible seepage indicated by the cattails, standing water, and boggy ground at the toe and downstream of the toe could affect the structural stability of the dam. If caused by seepage and if the rate of seepage were to increase, it is possible that the seepage could transport soil particles which could cause piping of embankment material. This could lead to an eventual failure of the embankment.

2. The trees observed on the downstream slope pose a potential danger to the safety of the dam depending upon the extent of the root system. The roots of trees present possible paths for piping through the embankment. The root systems can also do damage to the

embankment from being uprooted during a storm.

3. The wave erosion on the upstream slope does not appear to affect the stability of the dam in its present condition. Measures have been taken, according to Mr. Philips, to control the erosion (e.g., the planting of the canary reed grass). Nevertheless, continual erosion of the slope can only be detrimental to the stability of the dam.

4. The vegetation on the embankment should be properly maintained. A tall growth of vegetation on the embankment hinders a comprehensive inspection of the dam and potential problems could go undetected.

5. The moss and other miscellaneous floating debris get caught in a position of half in and half out of the drop inlet, but eventually pressure can build until the floating debris falls to the bottom of the standpipe and the into the spillway pipe (see Photo 6). If this situation continues unchecked, it could cause a severe blockage in the service spillway system, thus causing reservoir levels to rise faster than necessary during heavy reservoir inflows.

6. The anti-vortex plate has a coating of rust as do the supports to which it is welded. As the rusting gradually becomes more severe, more corrosive action could take place causing the weakening and possible failure of the plate (see Photo 6).

7. The rutting in the emergency spillway approach is a relatively small item at this time, and is easily correctable.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

There are no specific operational procedures for the Perry Philips Dam. The dam was built to impound water primarily for recreational purposes.

4.2 Maintenance of Dam

The dam and appurtenant structures are maintained by the owner, Mr. Perry Philips and his resident maintenance crew. The top of dam appears to be in fair condition and is covered with a one lane gravel road. According to the owner, Mr. Philips, the road was recently graded. Mr. Philips also stated that the slopes are too steep to mow and, consequently, the slopes are covered with a tall unmaintained grass cover. There are several trees growing on the downstream slope, and erosion due to wave action has occurred on the upstream slope near the waters edge.

4.3 Maintenance of Operating Facilities

There are no operable facilities at the damsite.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system consisting of any electrical or manual warning notification plans in effect for this dam.

4.5 Evaluation

The operation procedures are nonexistent and maintenance for Perry Philips Dam seems to be adequate. Although the dam does not appear to be neglected, the remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

The watershed area of the Perry Philips Dam upstream from the dam axis consists of approximately 353 acres. The watershed area is mostly pasture and range land with some urbanized areas. Land gradients in the watershed average roughly 2 percent. The Perry Philips Dam and Reservoir are located on an unnamed tributary of Clear Creek. The reservoir is about 0.5 miles upstream from the confluence of the unnamed tributary and Clear Creek. The watershed is approximately 1 mile long at its longest arm. A drainage map showing the watershed and the downstream hazard zone is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Perry Philips Dam was based upon criteria set forth in the Corps of Engineers' "Engineer Regulation No. 1110-2-106" and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distributon was based upon criteria given in the Corps of Engineers' EM 110-2-1411 (Standard Project Storm). The Soil Conservation Service (SCS) method was used for deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). The unit hydrograph parameters are presented in Appendix B. The SCS method also was used for determining the loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group

of the watershed and the SCS curve numbers are presented in Appendix B. The curve number, unit hydrograph parameters, the PMP index rainfall and the percentages for various durations were direct input into the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak inflows of the PMF and the one-half PMF are 5,824 cfs and 2,912 cfs, respectively.

Both the PMF and the one-half PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. A storm of 50 percent of the PMF preceded the PMF and a storm of 25 percent of the PMF preceded the one-half PMF, each by four days. The reservoir was assumed at the mean annual high water level at the beginning of the antecedent storms. The mean annual high water level for Perry Philips Dam Reservoir was estimated to be at the crest of the service spillway. The antecedent storm of 50 percent of the PMF, when routed through the reservoir, will leave the reservoir at approximately the same elevation as the crest of the service spillway at the end of the four day period. Thus, the reservoir was assumed at the crest level of the service spillway at the start of the routing computation for the PMF, the one-half PMF and other PMF ratio floods. The peak outflow discharges for the PMF and the one-half PMF are 4,777 and 1,916 cfs, respectively. Both the PMF and the one-half PMF when routed through the reservoir resulted in overtopping of the dam.

The sizes of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dam were taken from field notes and sketches prepared during the field inspection. The reservoir elevation-area data were obtained from the U.S.G.S. Columbia, Missouri Quadrangle topographic map (7.5 minute series). The reservoir elevation-area curve and the spillway and overtop rating curve are presented as Plates 2 and 3, respectively, in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam must aim at avoiding overtopping. Overtopping is especially dangerous for an earth dam because of its erodable characteristics. The safe hydrologic design of an embankment dam requires a spillway discharge capability combined with an embankment height that can handle a very large and exceedingly rare flood without overtopping the dam.

The Corps of Engineers designs dams to safely pass the Probable Maximum Flood that could be generated from the dam's watershed. This is the generally accepted criterion for major dams throughout the world and is the standard for dam safety where overtopping would pose any threat to human life. Accordingly, the hydrologic requirement for safety for this dam is the capability to pass the Probable Maximum Flood without overtopping the dam.

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this dam site. However, according to the owner, flow of an undetermined depth has passed through the emergency spillway on one or two occasions since 1964. Reportedly, the dam has also never been overtopped.

c. Visual Observations

Observations made of the spillways during the visual inspection are discussed in Section 3.1.d and evaluated in Section 3.2

d. Overtopping Potential

As indicated in Section 5.1a, both the Probable Maximum Flood and the one-half Probable Maximum Flood when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and the one-half PMF are 4,777 and 1,916 cfs,

respectively. The maximum capacity of the spillway just before overtopping the dam is 149 cfs. The PMF overtopped the dam by 2.62 feet and the one-half PMF overtopped the dam by 1.82 feet. The total duration of flow over the lowest point on the top of dam is 11.67 hours during the PMF and 7.42 hours during the occurrence of the one-half PMF. The spillway/reservoir system of Perry Philips Dam is capable of accommodating a flood equal to approximately 12 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Perry Philips Dam will not accommodate the one percent chance (100-year flood) flood without overtopping the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately six miles downstream of the dam. There are three dwellings, one building and three sheds within the damage zone.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no major signs of settlement or distress observed on the embankment or foundation during the visual inspection. The embankment is protected against surface erosion by an adequate cover of unmaintained vegetation. The possible seepage observed near the bend in the dam axis does not appear to affect the stability of the dam in its present condition. Nevertheless, any increases in the condition of the seepage can only be detrimental to the embankment. The erosion due to wave action on the upstream slope does not appear to be serious enough to constitute an unsafe condition and according to Mr. Philips, steps have been taken to control the problem. Nevertheless, the erosional problem should be monitored and corrective measures should be taken when deemed necessary. There was no indication of past or present slope instability. In the absence of seepage and stability analyses, no quantative evaluation of the structural stability can be made.

The service and emergency spillways appeared to be structurally stable on the day of the inspection, as there were nc obvious weak spots observed or seepage found in connection with the spillways at the inlet or outlet areas.

b. Design and Construction Data

No design computations were uncovered during the report preparation phase. Parameters used for the hydraulic design of the spillways and boring logs of materials encountered in the borrow areas and in the embankment foundation are shown on the design

drawing presented in this report (see Plate 4). Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the dam or appurtenant structures. No regulated outlet works system was provided for the dam. The water level on the day of the visual inspection was at the crest of the service spillway. The reservoir remains close to full at all times, according to Mr. Philips.

d. Post Construction Changes

No post construction changes are known to exist which will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1 (see Plate 5), as defined in "Recommended Guidelines for Safety Inspection of Dams" prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude which would be expected in Seismic Zone 1 will not cause distress to a well designed and constructed earth dam. Available literature indicates that no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and the visual inspection. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation, however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of the inspection along with data available to the inspection team.

It is also important to realize that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Perry Philips Dam is found to be "Seriously Inadequate". The spillway/reservoir system will accommodate about 12 percent of the PMF without overtopping the dam. The safety of the embankment will be in jeopardy if the dam is overtopped. The dam itself would be susceptible to erosion due to the high velocity of flow on its downstream slope which could lead to an eventual failure of the dam.

The dam and appurtenant structures appeared to be in satisfactory condition. However, no quantitative evaluation of the structural safety of the embankment can be made in view of the absence of seepage and stability analyses. The present embankment and appurtenant structures, however, have reportedly performed satisfactorily since their construction without failure or evidence of instability. The dam has reportedly never been overtopped.

The safety of the dam can be improved if the deficiencies described in Section 3.2 and 6.1a and below are properly corrected according to the procedure given in Section 7.2b. The trees on the downstream slope could jeopardize the safety of the dam.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurements, the design drawing, past performance and the present condition of the dam. The design drawing was of limited use to the overall assessment of the dam and appurtenant structures. Information on the operation and maintenance of the dam was not available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were also not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time. The items recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

There are several general options which may be considered to reduce the possibility of dam failure or to deminish the harmful aspects of such a failure. Some of these options are:

1. Increase the spillway capacity to pass the PMF without overtopping.

2. Increase the height of the dam enough to pass the PMF without overtopping the dam; an investigation should be done which also includes studying the effects on the structural stability of the existing embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

b. O & M Procedures

1. The potential seepage at the toe of the slope and downstream of the toe should be monitored to detect any changes in turbidity, location or quantity. Any changes should be investigated further under the guidance of an engineer experienced in the design and construction of earth dams and repairs made as necessary.

2. Remove the trees from the downstream slope of the dam. Removal of large trees should be accomplished under the guidance of an engineer experienced in the design and construction of earth dams.

3. The erosion due to wave action on the upstream slope should be monitored and if the erosion continues, protective measures should be employed to protect the slope from further damage. The repairs should be accomplished under the guidance of an engineer experienced in the design and construction of earth dams.

4. The vegetation on the embankment should be properly maintained and an adequate vegetative cover retained on the embankment to protect it from surface erosion and to prevent excessive erosion in the event the dam is overtopped. A high dense growth of vegetation on the embankment could prevent a comprehensive inspection of the dam and potential problems could go undetected.

5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

6. The moss and weed growth in and around the service spillway inlet area should be cleared away and prevented from returning and accumulating.

7. The condition of rust on the service spillway inlet and outlet areas should be monitored and watched for the occurrence of more corrosive reaction.

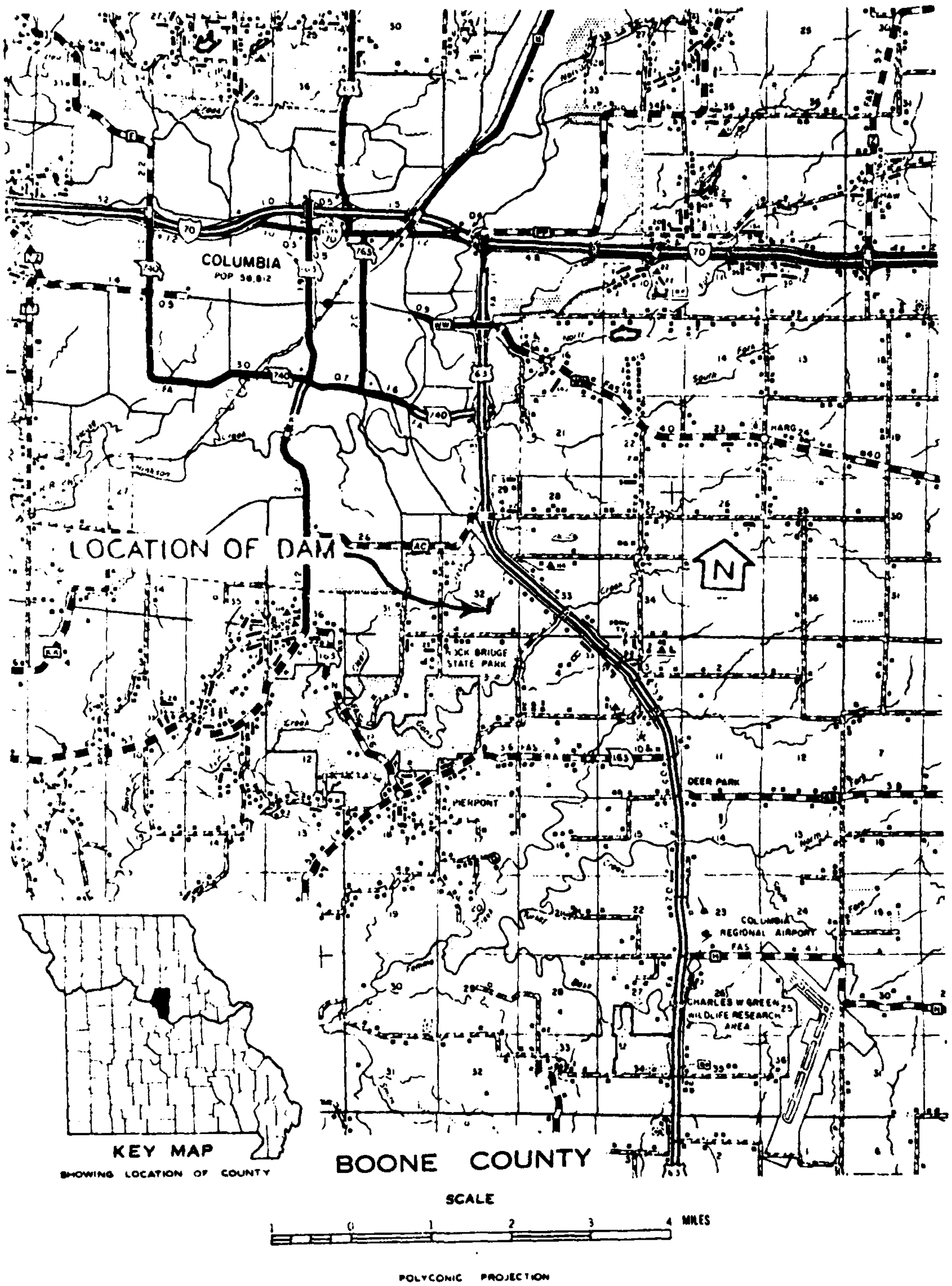
8. The rutting in the emergency spillway approach area should be refinished to the same degree of protection as the surrounding spillway crest and channel.

9. The owner should initiate the following programs:

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

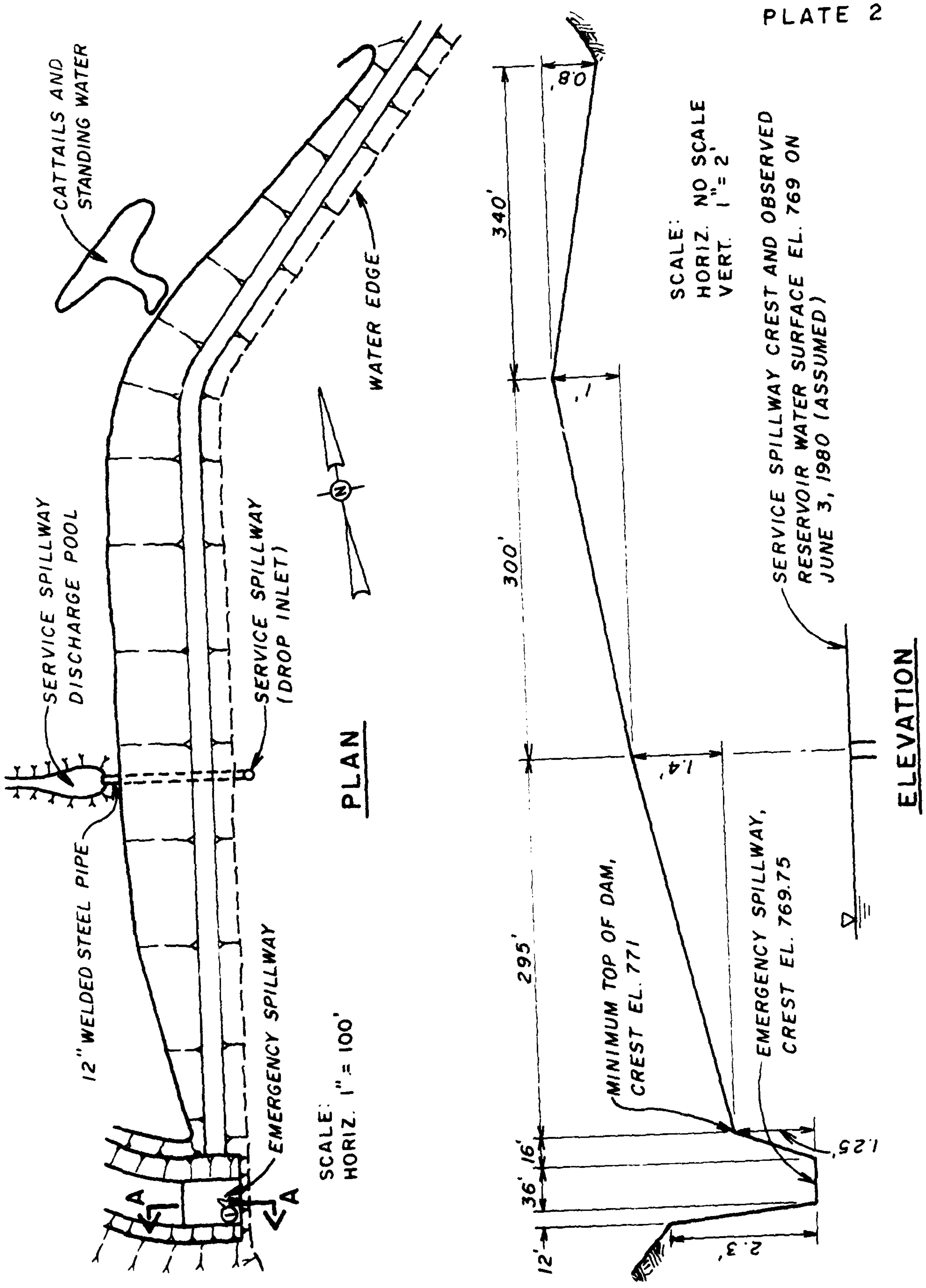
PLATES



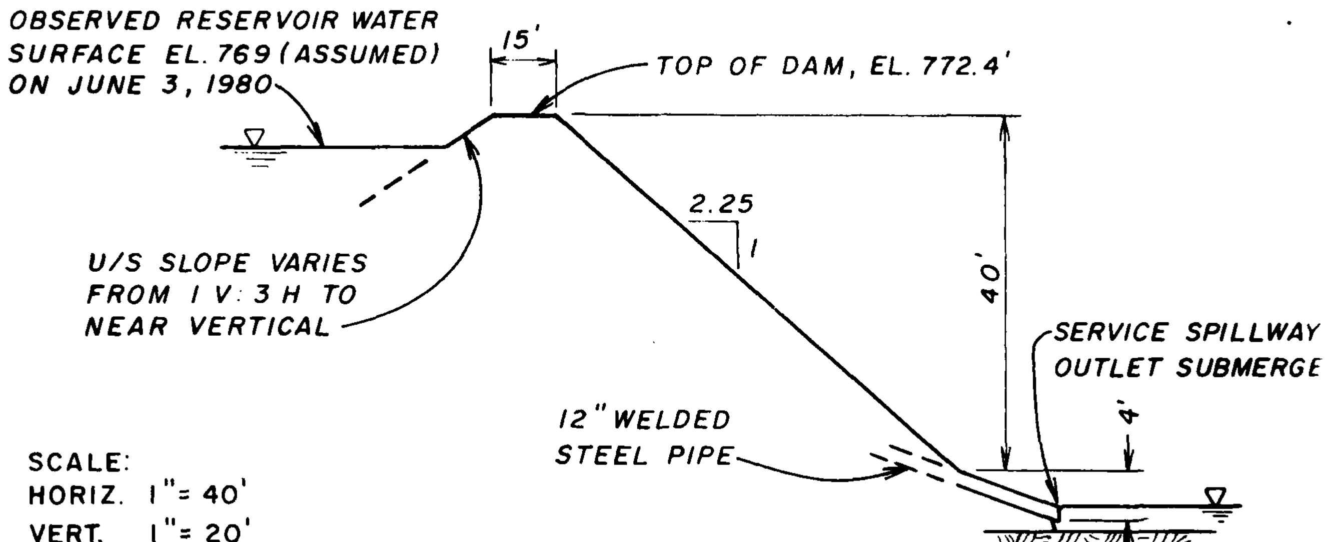
LOCATION MAP - PERRY PHILIPS DAM

MO. 10019

PLATE 2

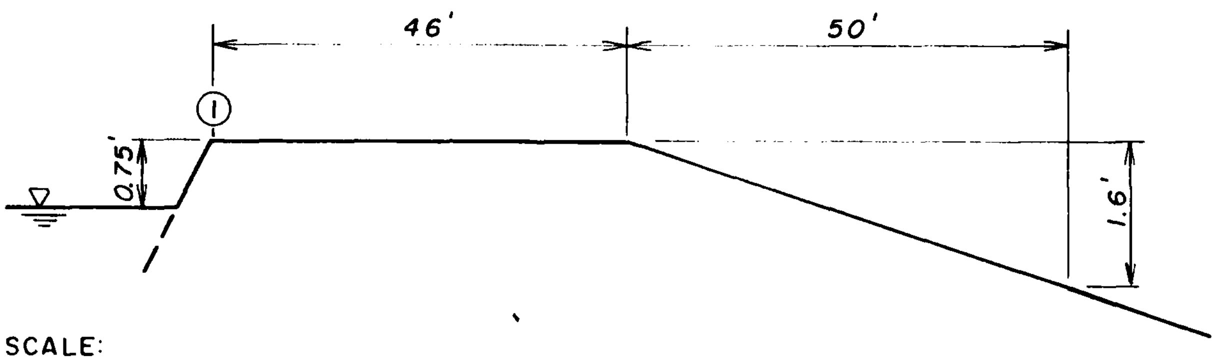


PERRY PHILIPS DAM (MO. 10019)
PLAN AND ELEVATION
(SHEET 1 OF 2)



SCALE:
HORIZ. 1" = 40'
VERT. 1" = 20'

MAXIMUM SECTION



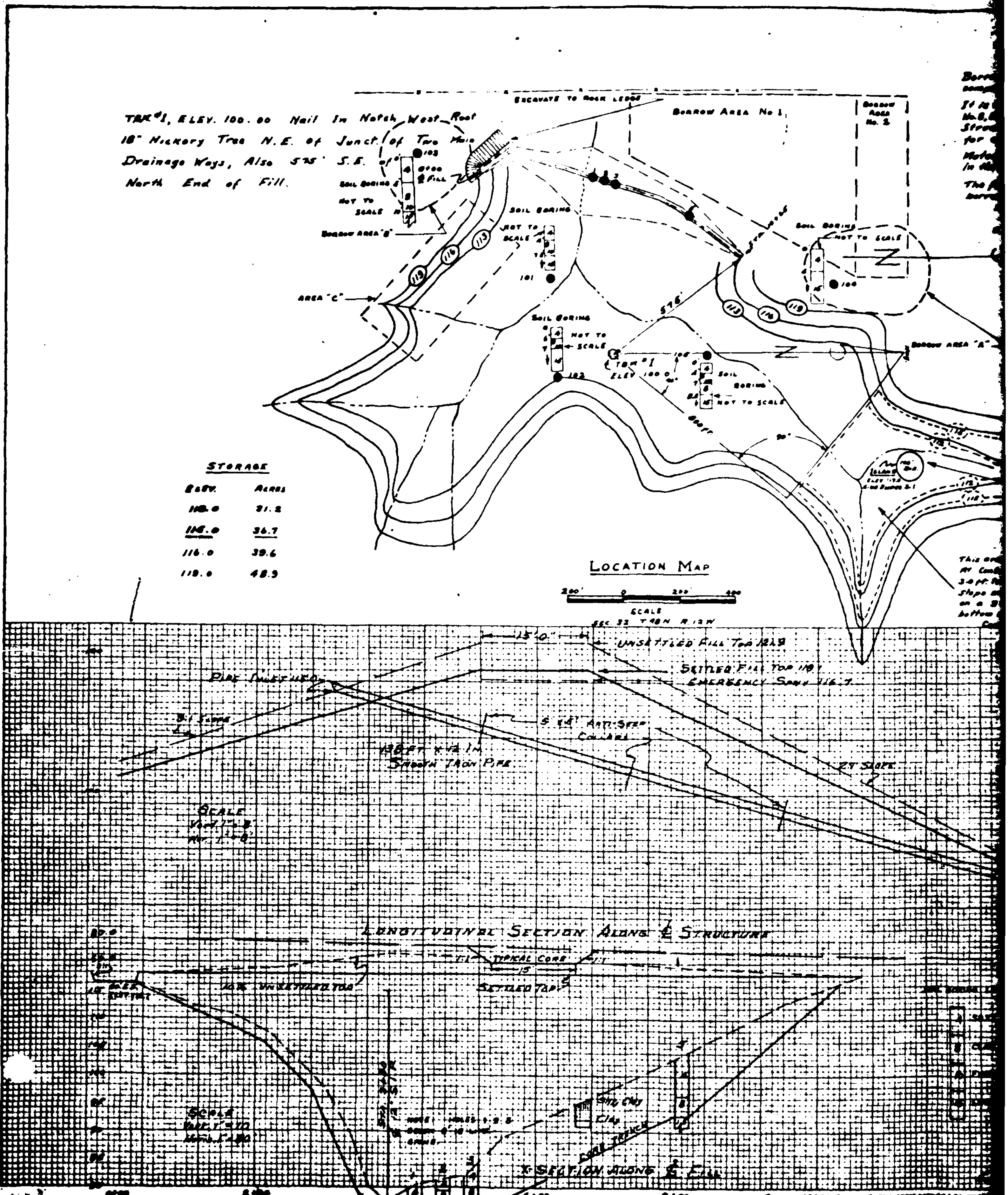
SCALE:
HORIZ. 1" = 20'
VERT. 1" = 2'

SECTION A-A

EMERGENCY SPILLWAY PROFILE

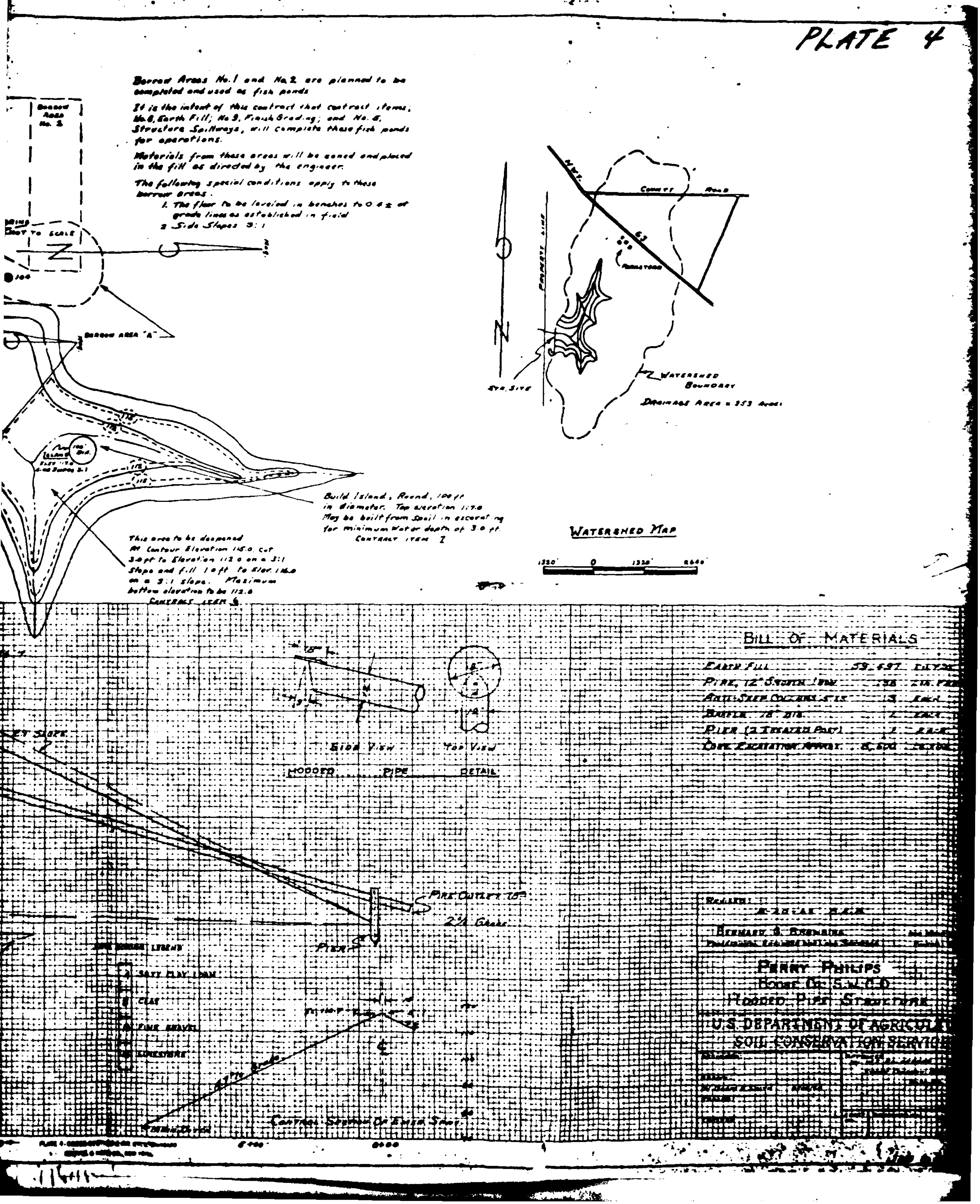
(1) REFERENCE POINT, SEE SHEET 1 OF 2

PERRY PHILIPS DAM (MO. 10019)
MAXIMUM SECTION OF EMBANKMENT AND
EMERGENCY SPILLWAY PROFILE
(SHEET 2 OF 2)

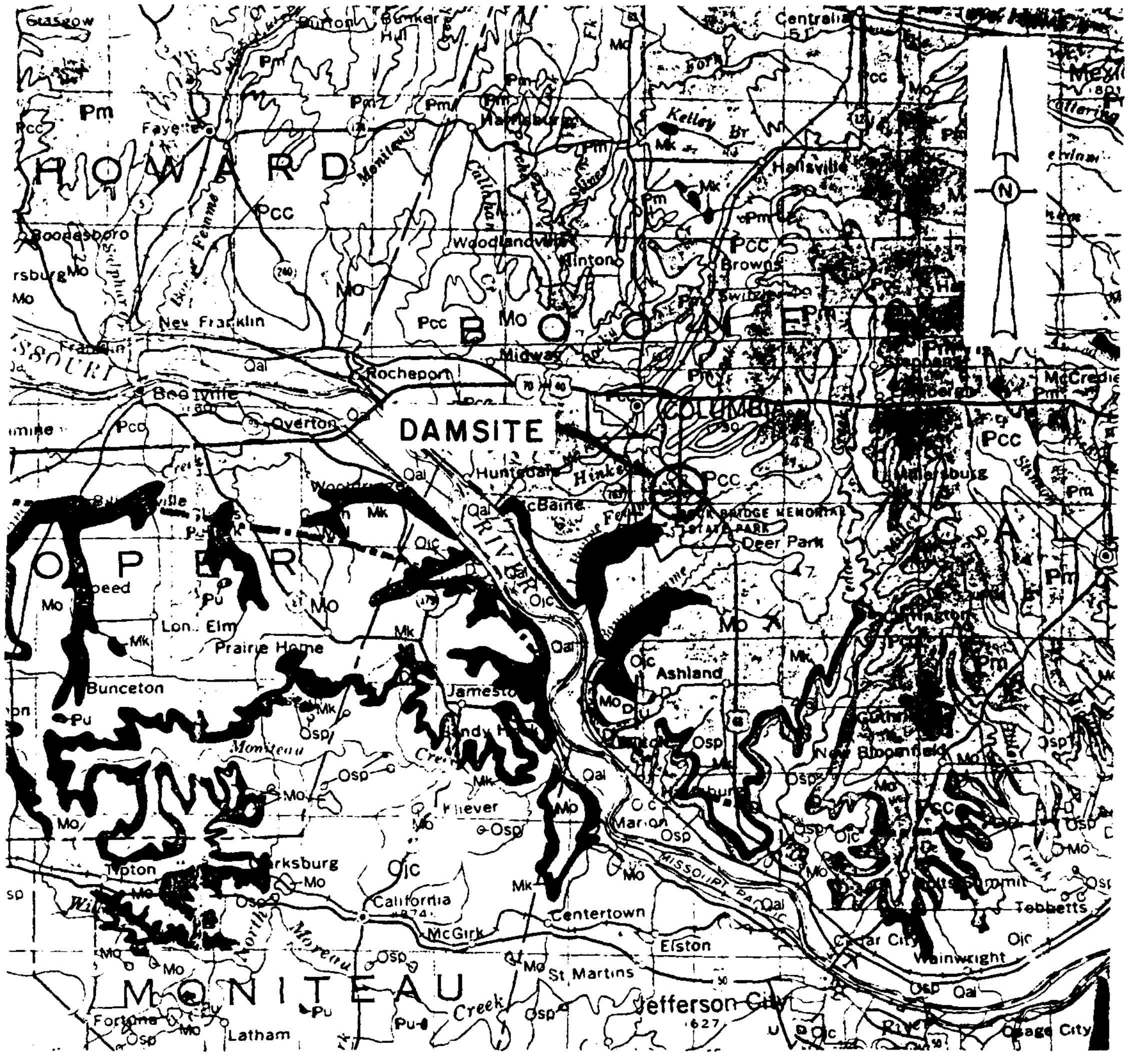


TBM #1, ELEV. 100.00 Nail In Notch West Root 18" Hickory Tree N.E. of Junct. of Two Main Drainage Ways, Also 575' S.E. of ℄ North End of Fill.
EXCAVATE TO ROCK LEDGE
BORROW AREA No. 1
BORROW AREA "B"
BORROW AREA "A"
AREA "C"
SOIL BORING
NOT TO SCALE
575'
STORAGE
ELEV. ACRES
110.0 31.2
113.0 36.7
116.0 39.6
119.0 48.9
LOCATION MAP
SCALE
SEC. 32 T48N R.12W
UNSETTLED FILL TOP 121.9
SETTLED FILL TOP 119
EMERGENCY SPWY 116.7
3:1 SLOPE
5 - 4' ANTI-SEEP COLLARS
2:1 SLOPE
SCALE
LONGITUDINAL SECTION ALONG ℄ STRUCTURE
TYPICAL CORE
UNSETTLED TOP
SETTLED TOP
Silty Clay
Clay
CORE TRENCH
X-SECTION ALONG ℄ FILL
SCALE

PLATE 4



Borrow Areas No. 1 and No. 2 are planned to be completed and used as fish ponds
It is the intent of this contract that contract items; No. 8, Earth Fill; No. 9, Finish Grading; and No. 5, Structure Spillways, will complete these fish ponds for operations.
Materials from these areas will be zoned and placed in the fill as directed by the engineer.
The following special conditions apply to these borrow areas.
1. The floor to be leveled in benches to 0.4 ± of grade lines as established in field
2. Side Slopes 3:1
Borrow Area No. 2
Not to scale
Borrow Area "A"
Build Island, Round, 100 ft in diameter. Top elevation 117.0 May be built from soil in excavating for minimum water depth of 3.0 ft. Contract Item 7
This area to be deepened At Contour Elevation 115.0. Cut 3.0 ft to Elevation 112.0 on a 3:1 Slope and fill 1.0 ft to Elev. 116.0 on a 3:1 slope. Maximum bottom elevation to be 112.0 Contract Item 6
County Road
Property Line
Str. Site
Watershed Boundary
Drainage Area = 353 Acres
Watershed Map
1320' 0 1320' 2640'
Bill of Materials
Earth Fill 53,697 Cu.Yds.
Pipe, 12" Smooth Iron 136 Lin. Ft.
Anti-Seep Collars 5'x5' 3 Each
Baffle 18" Dia. 1 Each
Pier (2 Treated Post) 1 Each
Core Excavation Approx. 6,600 Cu.Yds.
Side View
Top View
Hooded Pipe Detail
Pipe Outlet 18"
2½ Grade
Pier
Legend
Sandy Clay Loam
Clay
Fine Gravel
Limestone
Control Section Of Emer. Spwy.
Bernard G. Brennan
Perry Phillips
Boone Co. S.W.C.D.
Hooded Pipe Structure
U.S. Department of Agriculture
Soil Conservation Service



SCALE

10 0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND OF THIS DAM IS ON PLATE 6

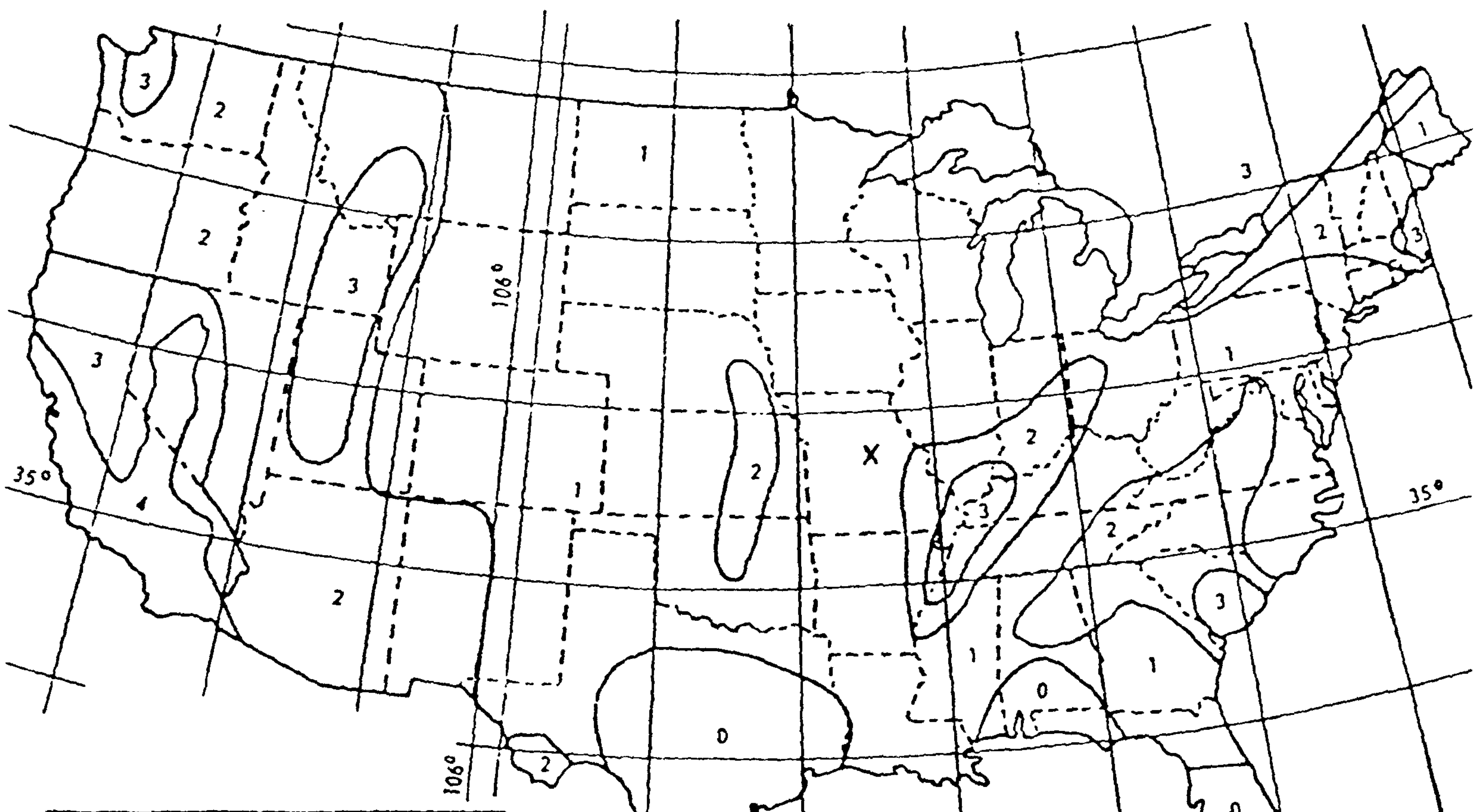
REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP OF PERRY PHILIPS DAM

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	Pu	PENNSYLVANIAN UNDIFFERENTIATED
	Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	Mo	KEOKUK-BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	CHOUTEAU GROUP: NORTHVIEW, COMPTON AND BACHELOR FORMATION (LIMESTONE AND SHALE)
DEVONIAN	D	SULPHUR SPRING GROUP: BUSHBERG SANDSTONE, GLEN PARK LIMESTONE, GRASSY CREEK SHALE
ORDOVICIAN	Osp	ST PETER SANDSTONE
	Ojc	SMITHVILLE FORMATION, POWELL DOLOMITE



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

X APPROXIMATE LOCATION OF PERRY PHILIPS DAM

SEISMIC ZONE MAP
of
CONTIGUOUS STATES

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

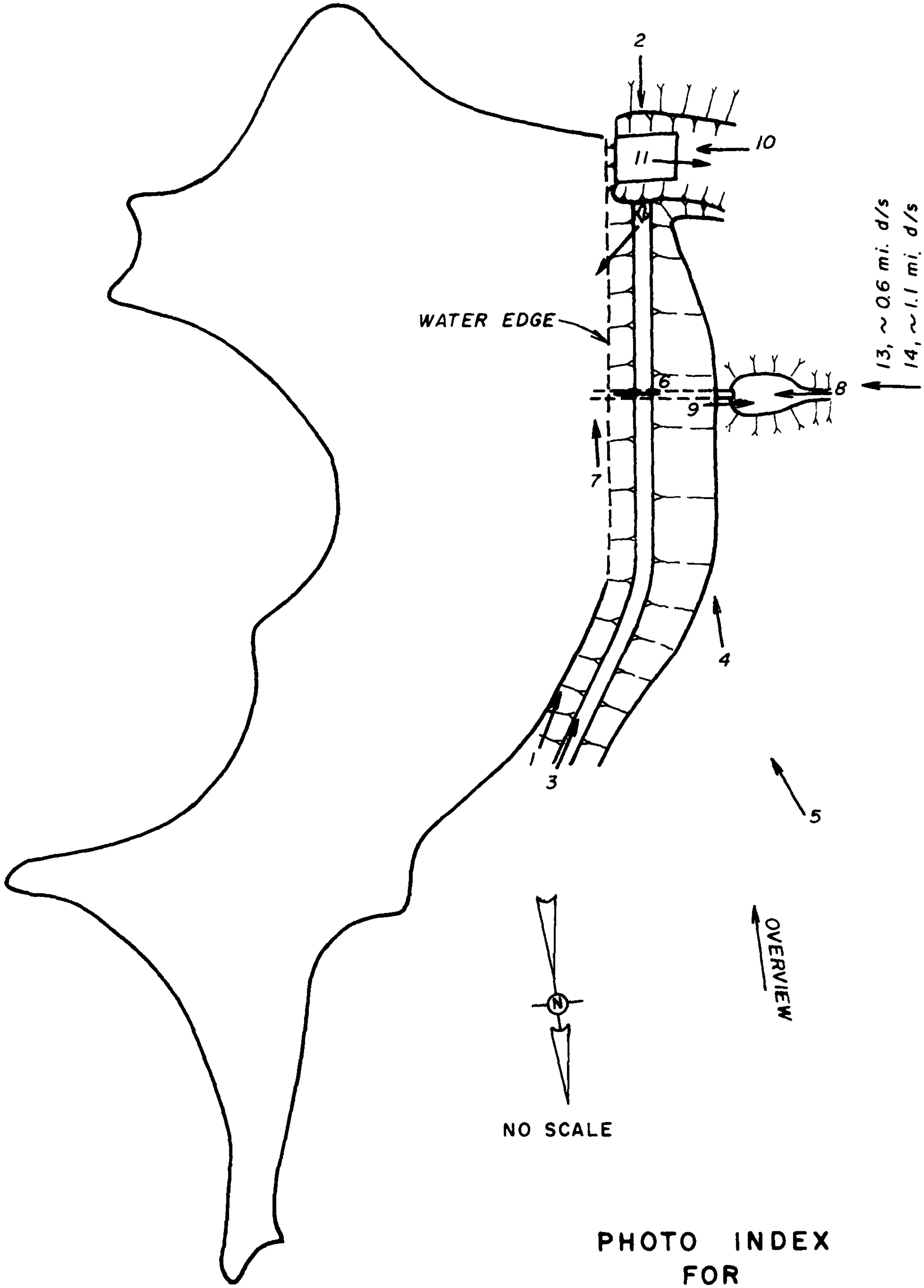


PHOTO INDEX
FOR
PERRY PHILIPS DAM

Perry Philips Lake Dam

Photographs

Photo 1 - View of the upstream slope from the right side showing the reeds canary grass.

Photo 2 - View of the top of dam looking across the emergency spillway.

Photo 3 - View of the top of dam and upstream slope from the right side of the embankment.

Photo 4 - View of the downstream slope.

Photo 5 - View of the downstream slope showing the area of possible seepage. The area shows up in the photo as the dark green area in the center of the photo.

Photo 6 - View of the service spillway drop inlet showing the anti-vortex steel plate, the moss-weed growth over spillway edge, and the lack of some kind of trashrack.

Photo 7 - View of the upstream slope showing the location of the service spillway.

Photo 8 - View of the submerged outlet of the service spillway.

Photo 9 - View of the downstream channel from the outlet of the service spillway.

Photo 10 - View of the control section of the emergency spillway looking toward the reservoir.

Photo 11 - View of the discharge channel of the emergency spillway showing sheet flow type discharge channel.

Photo 12 - View of the reservoir and rim.

Photo 13 - View of a dwelling approximately 0.6 miles downstream of the dam taken from the downstream channel.

Photo 14 - View of a dwelling approximately 1.1 miles downstream of the dam taken from the downstream channel.

Photo 1

Photo 2

Photo 3

Photo 4

Perry Philips Dam

Photo 5

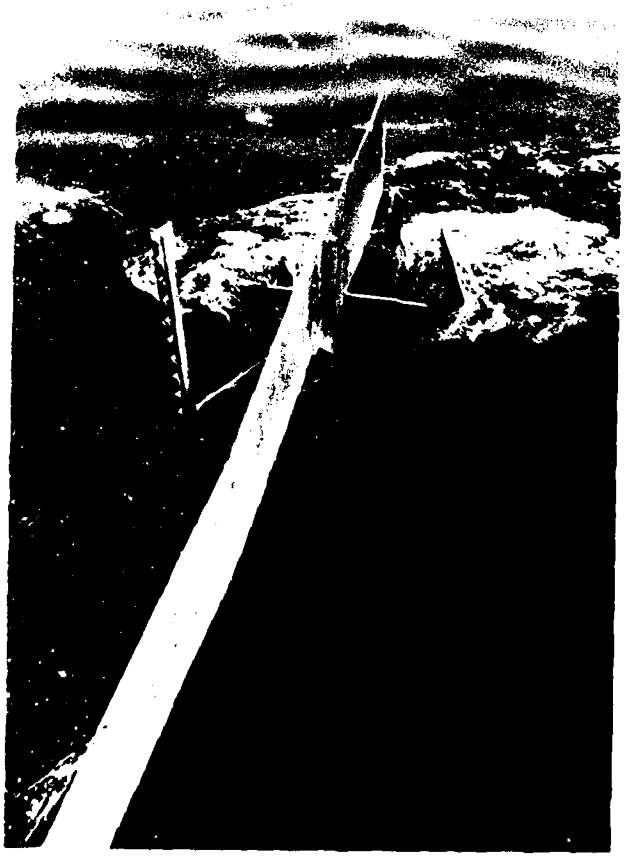


Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

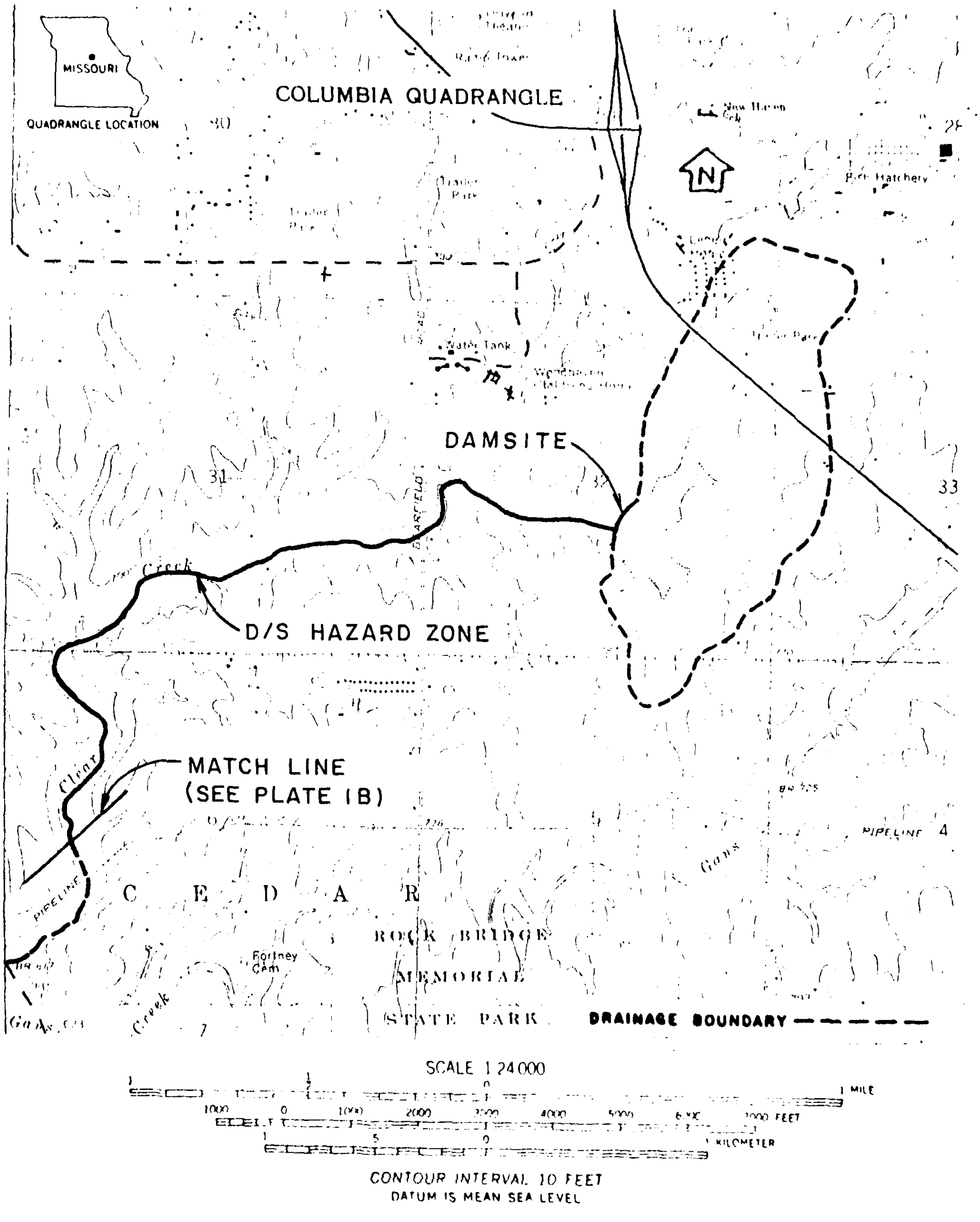
Photo 12

Photo 13

Photo 14

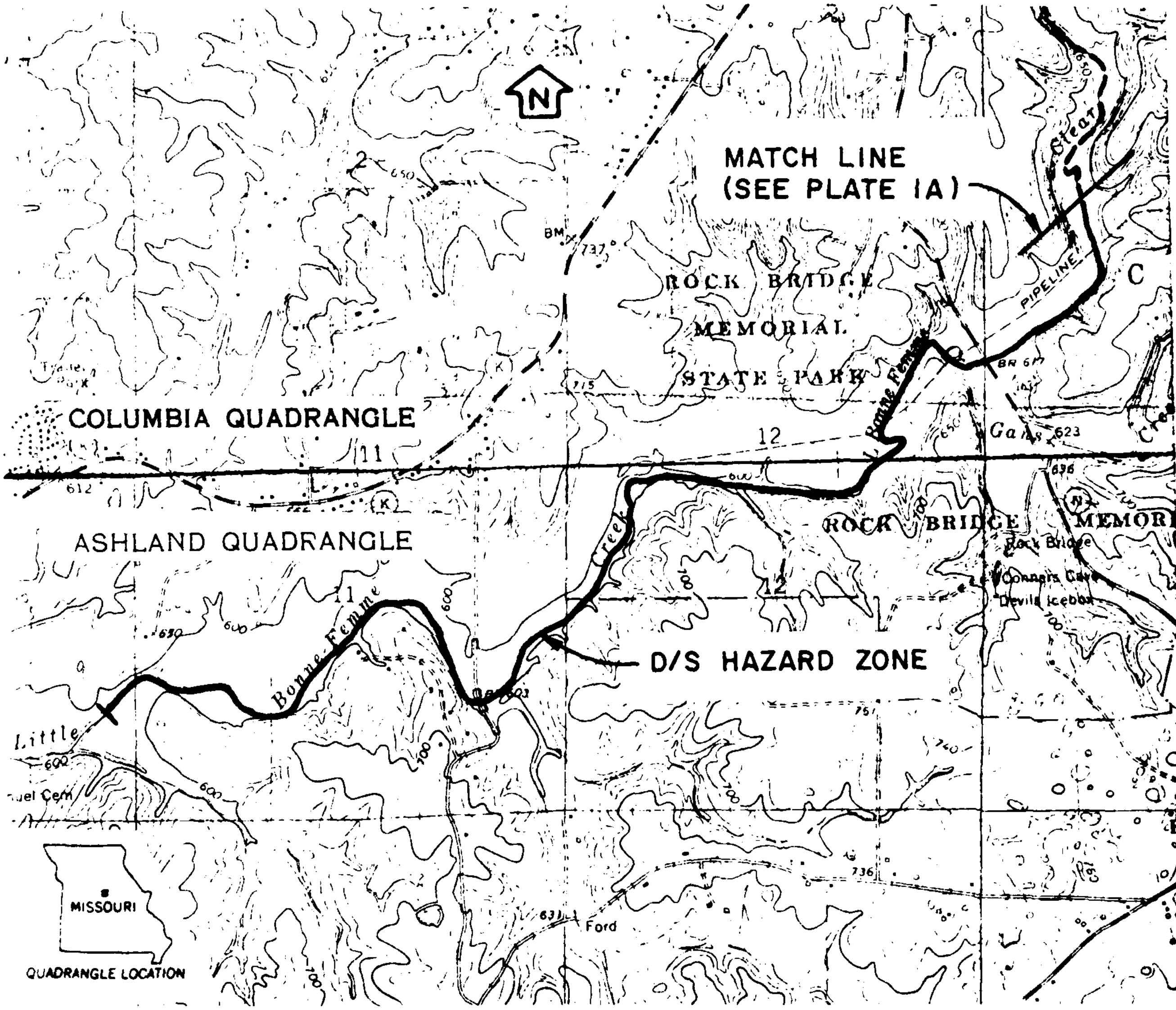
APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS



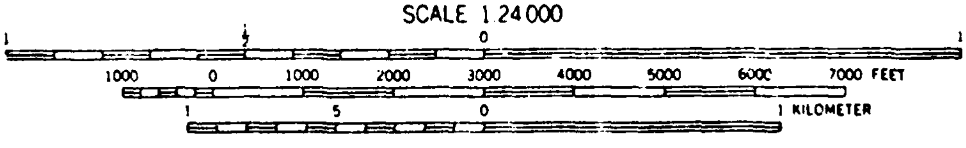
PERRY PHILIPS DAM (MO. 10019)
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE

PLATE 1B, APPENDIX B



DRAINAGE BOUNDARY — — — — —

SCALE 1:24000



PERRY PHILIPS DAM (MO. 10019)
DRAINAGE BASIN AND
DOWNSTREAM HAZARD ZONE

ECI-4 PRC ENGINEERING CONSULTANTS, INC.

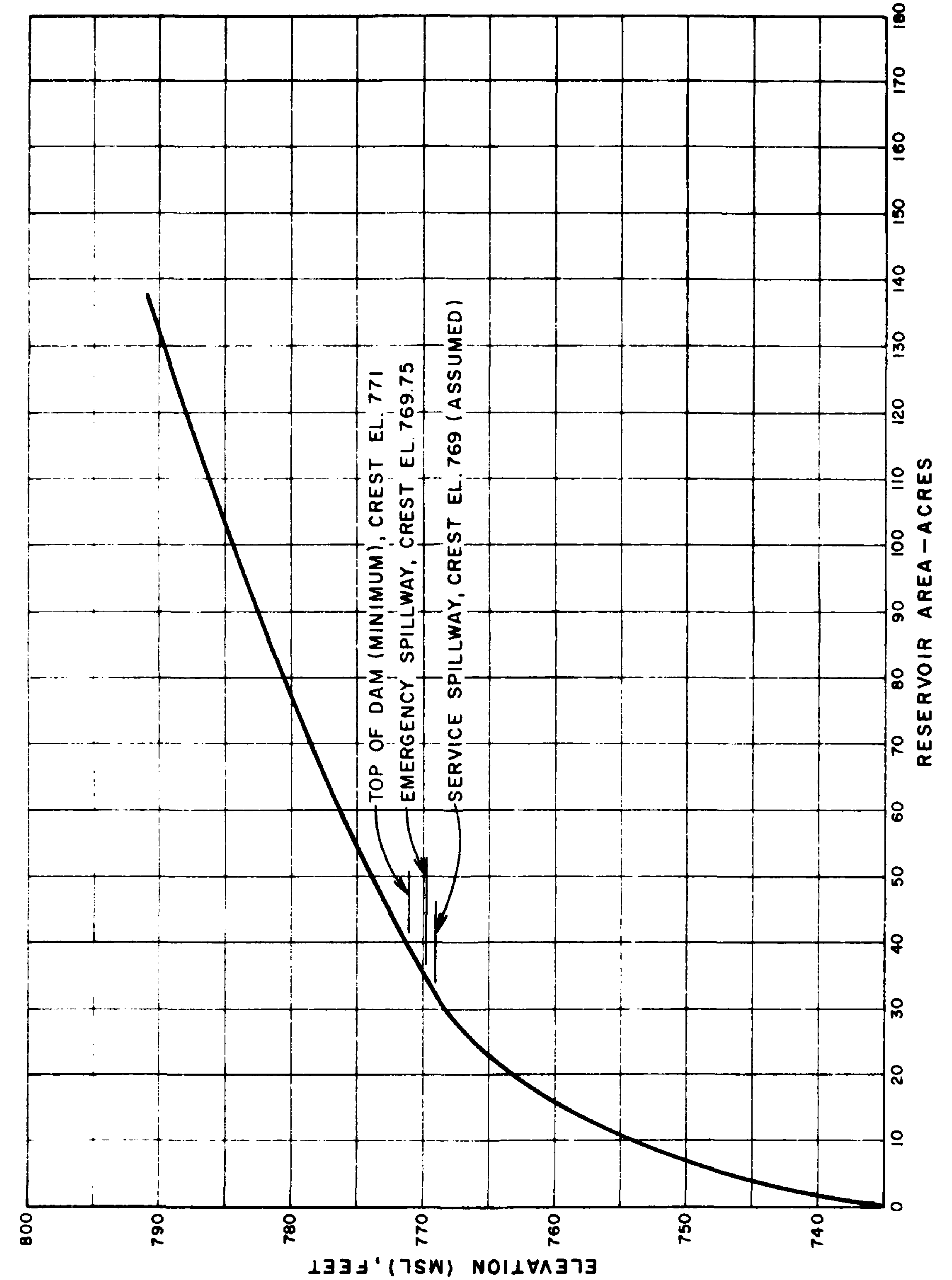
DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF 1

DAM NAME: PERRY PHILIPS DAM / ID NO.: 10019 JOB NO. 1263

RESERVOIR ELEVATION-AREA DATA BY F.Z. KIB DATE 6/27/[illegible]

ELEV. (M.S.L.) (Ft.)	RESERVOIR SURFACE AREA (Acres)	REMARKS
735	0	Estimated Streambed at dam
740	2	Interpolated
750	7	"
760	16	"
769	31	Service Spillway Crest (Assumed)
769.75	35	Emergency Spillway Crest
770	36.5	Measured on USGS Quad.
771	39	Top of dam (Minimum)
780	77.0	Measured on USGS Quad
790	132.0	"

PLATE 2, APPENDIX B



PERRY PHILIPS DAM (MO. 10019)
RESERVOIR ELEV.- AREA CURVE

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 1

DAM NAME: PERRY PHILLIPS DAM (MO 10019) — JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS — BY DC / RLB — DATE 6-23-80

1) DRAINAGE AREA, A = .55 sq. mi = (353 acres)

2) LENGTH OF STREAM, L = (1.9 " × 2000 ' = 3800 ') = .72 mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$H_1 = 833$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 769.0$

5) ELEVATION OF CHANNEL BED AT 0.85L, $E_{85} = 822$

6) ELEVATION OF CHANNEL BED AT 0.10L, $E_{10} = 775$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10}) / 0.75L = \frac{822-775}{.75(3800)} = 1.7\%$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$$t_c = [(11.9 \times L^3)/(H_1 - H_2)]^{0.385} = \left[\frac{(11.9 \times .72^3)}{833-769}\right]^{.385} = .358 \text{ hrs.}$$

B) BY VELOCITY ESTIMATE,

SLOPE = 1.7% ⇒ AVG. VELOCITY = 2 f/s

$t_c = L/V = 3800/(2)3600 = .53$ hrs.

USE $t_c = .358$ hrs.

9) LAG TIME, $t_\ell = 0.6\, t_c = .215$ hrs

10) UNIT DURATION, $D \le t_\ell / 3 = .072$ hrs. < 0.083 hr.

USE D = .083 hrs.

11) TIME TO PEAK, $T_p = D/2 + t_\ell = .256$ hrs

12) PEAK DISCHARGE,

$q_p = (484 \times A) / T_p = 1042$ cfs

ECM-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. 1 OF 1

DAM NAME: PERRY PHILLIPS DAM (MO 10019) JOB NO. 1263

CURVE NUMBER DETERMINATION BY DC / MLB DATE 6-23-80

I) SOIL GROUP

WATERSHED SOILS IN THE BASIN CONSIST OF:

C D C B D D
WELLER, KESWICK, LINDLEY, MANDEVILLE, PUTNAM, MEXICO

GROUP D SOILS SEEM TO PREDOMINATE THE BASIN. THEREFORE, ASSUME GROUP D SOILS FOR THE ENTIRE WATERSHED FOR HYDROLOGIC PURPOSES.

II) COVER COMPLEX

ASSUMED LAND USE	ASSUMED HYDROLOGIC CONDITION	PER CENT AREA	CN (AMC II)
Pasture + Range	Fair	95	84
Urban	Fair	5	90

III) CURVE NUMBER

WEIGHTED AVERAGE CN = 84 FOR AMC II

CURVE NUMBER = 93 FOR AMC III

PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. ____ OF ____
DAM NAME: PERRY PHILLIPS DAM (MO 10019) — JOB NO. 1263
PROBABLE MAXIMUM PRECIPITATION — BY D.C. / H.O. — DATE 6-23-80

DETERMINATION OF PMP

1) Determine drainage area of the basin.

D.A. = .5516 sq mi (353 acres)

2) Determine PMP Index Rainfall (for D.A. = 200 sq. mi. & 24 hr. duration)

Location of centroid of basin.

Long. = 92° 17' 15" Lat. = 38° 53' 57"

PMP = 24.9 (from Fig. 1, HMR 33)

Zone = 7

3) Determine basin rainfall in terms of percentage of PMP Index Rainfall for various durations.
(from Fig. 2, HMR 33)

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (Inches)	Rainfall Increments (Inches)	Duration of Increment (Hrs.)
6	100	24.9	24.9	6
12	120	29.9	5	6
24	130	32.4	2.5	12

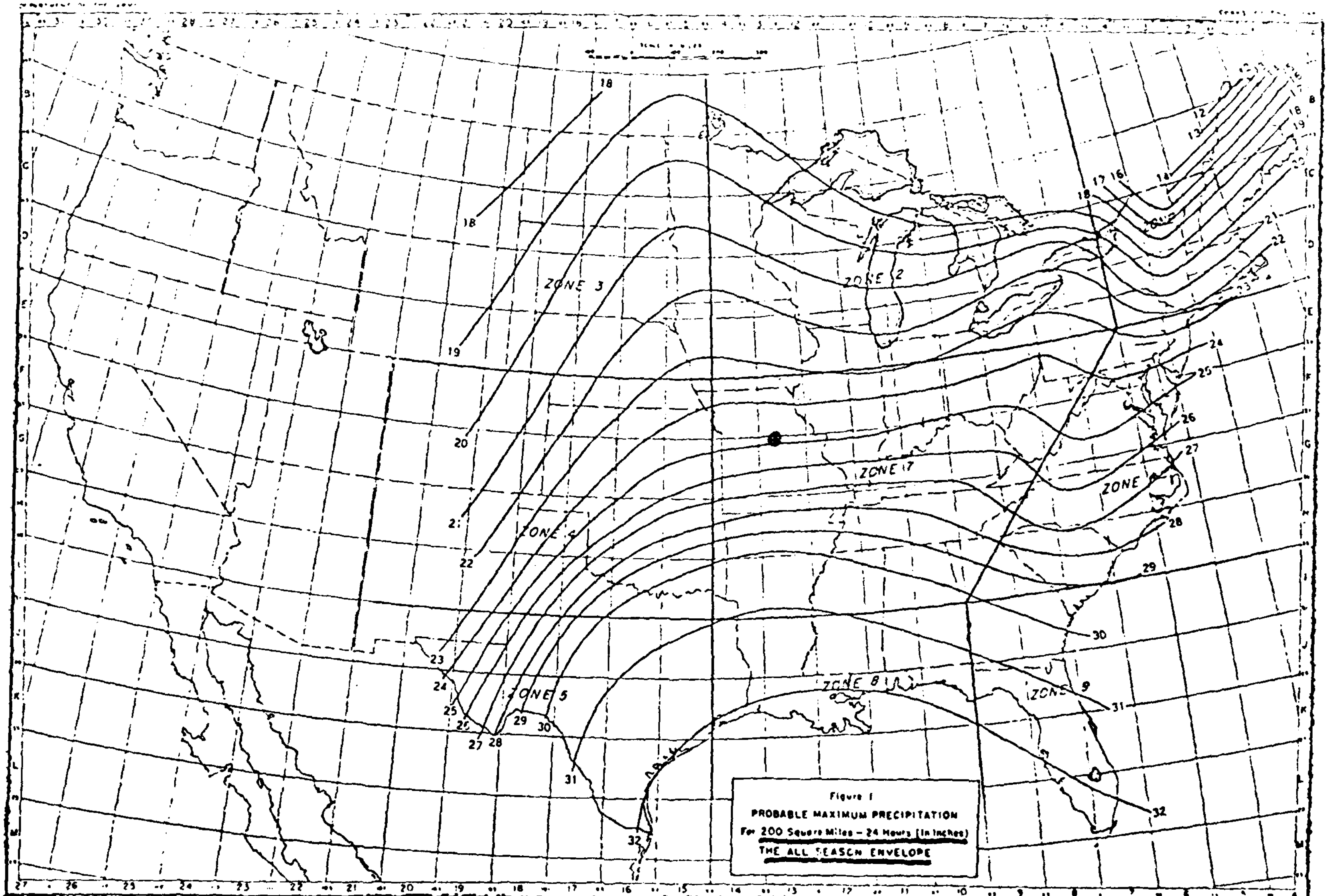


Figure 1
PROBABLE MAXIMUM PRECIPITATION
For 200 Square Miles – 24 Hours (In Inches)
THE ALL SEASON ENVELOPE

⊕ Location of Basin Centroid

Perry Phillips Dam (MO. 10019)

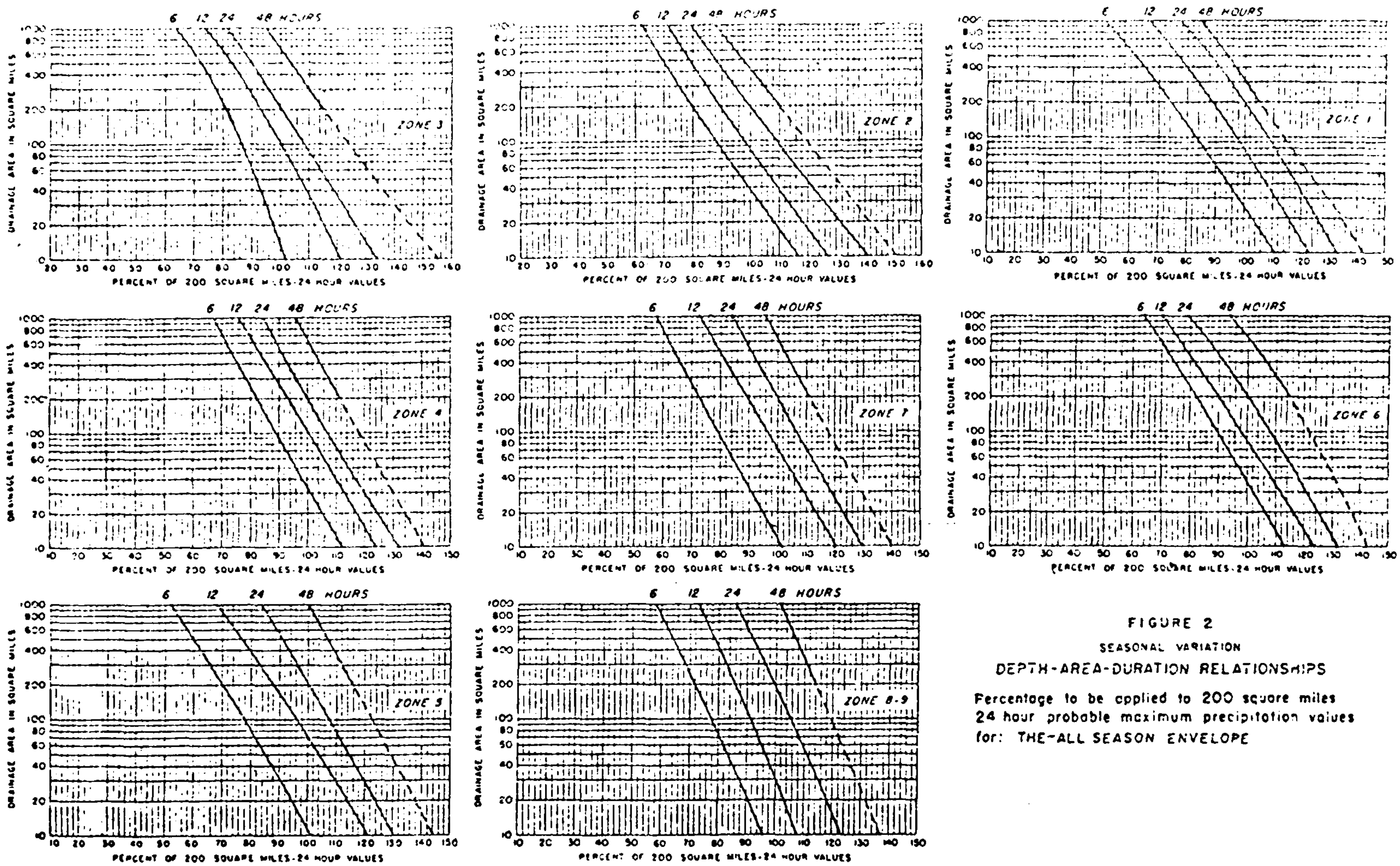


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles
24 hour probable maximum precipitation values
for: THE-ALL SEASON ENVELOPE

PRC ENGINEERING CONSULTANTS, INC.

Dam Safety Inspection / Missouri - 1980 SHEET NO. 3 OF 3

Perry Philips Dam (Mo. 10019) JOB NO. 1263

Service Spillway Rating Curve BY JFK / KLB DATE 7/1/80

W.S. ELEV	H	Q	CONTROLLING FLOW
769	0	0	
769.25	0.25	2.3	Weir Flow
769.5	0.50	6.4	" "
769.67	0.67	9.5	Orifice Flow
770	1.0	11.6	" "
770.51	1.51	14.2	" "
770.84	1.84	15.7	" "
771.11	42.01	16.9	Pressure Flow
771.41	42.31	16.9	" "
771.68	42.58	17.0	" "
771.96	42.86	17.0	" "
772.36	43.26	17.1	" "
772.82	43.72	17.2	" "
773.34	44.24	17.3	" "
773.91	44.81	17.4	" "
774.60	45.5	17.5	" "

Weir Flow : $Q = CLH^{3/2}$

$L = 5.5$

$H = WSEL - 769$

$C = 3.3$

$\Big\}\ Q = 18.15\,H^{3/2}$

Pressure Flow

$K_{ent} = 0.5$

$K_{exit} = 1$

$K_{bend + contraction} = 0.5$

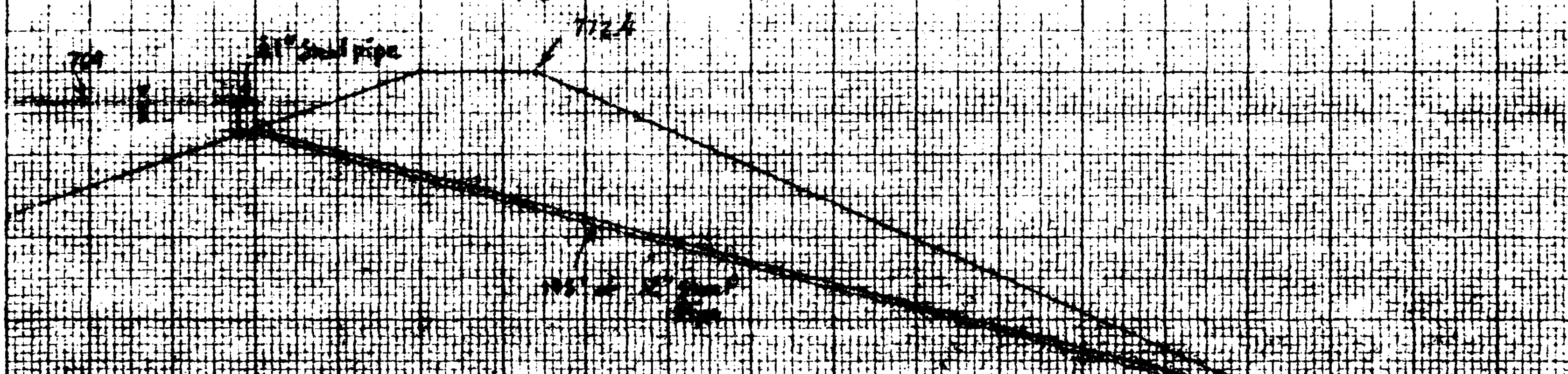
$K_{friction} = \dfrac{29.1 \times 0.012^2 \times 145}{0.25^{4/3}} = 3.86$

$\Big\}\ Q = A\sqrt{\dfrac{2gH}{K}} = 2.6\sqrt{H}$

$\Sigma K = 5.86$

$H = WSEL - 729.1$

Orifice Flow $Q = 0.6\,A\sqrt{2gH} = 11.58\sqrt{H}$ $H = WSEL - 769$

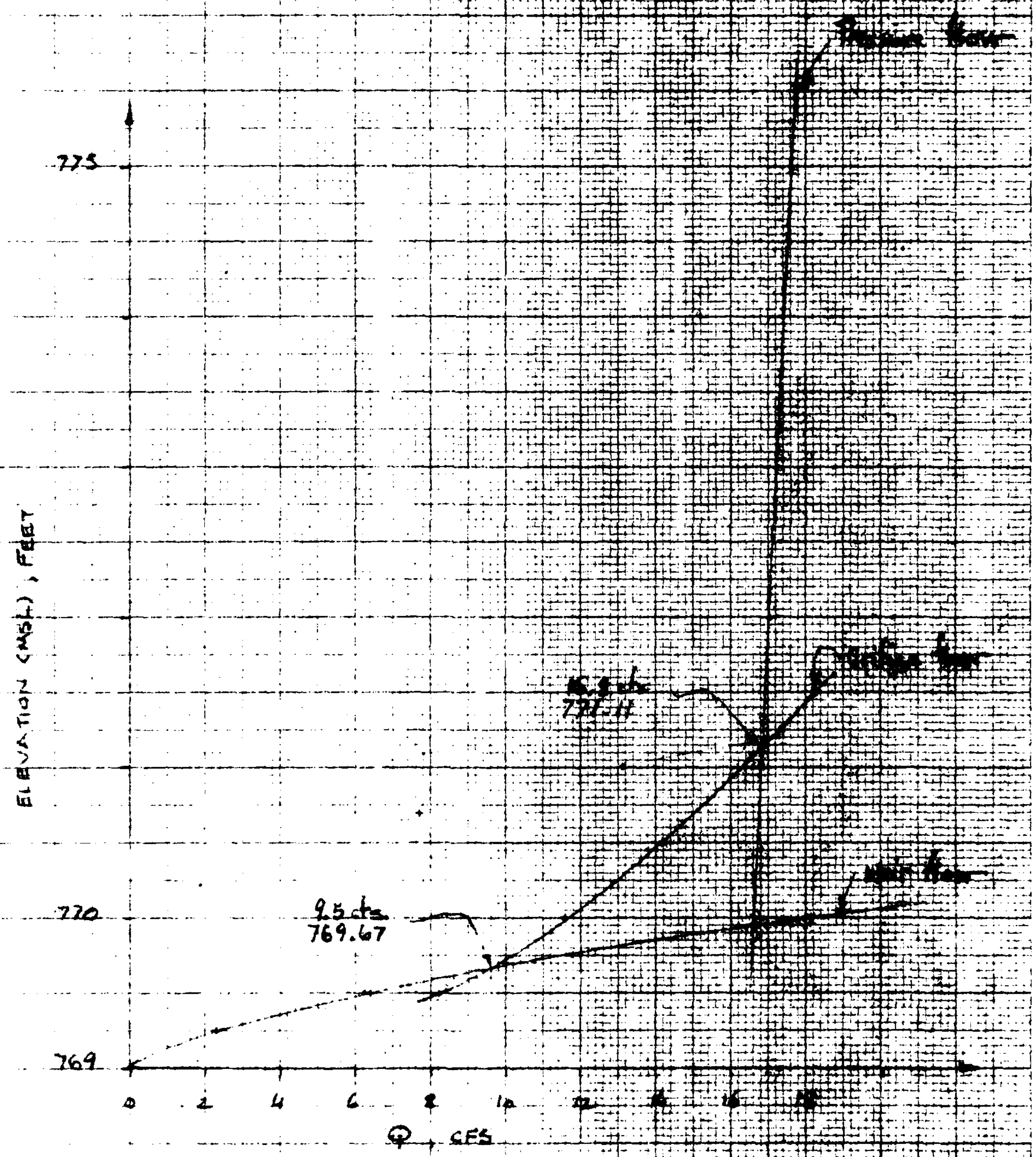


DAM SAFETY INSPECTION / MISSOURI - 1980

PHILLIPS DAM (MO. 10093)

SERVICE SPILLWAY RATING CURVE

DAM SAFETY INSPECTION / Missouri –
PERRY PHILIPS DAM (MO 10013)
SERVICE SPILLWAY RATING CURVE

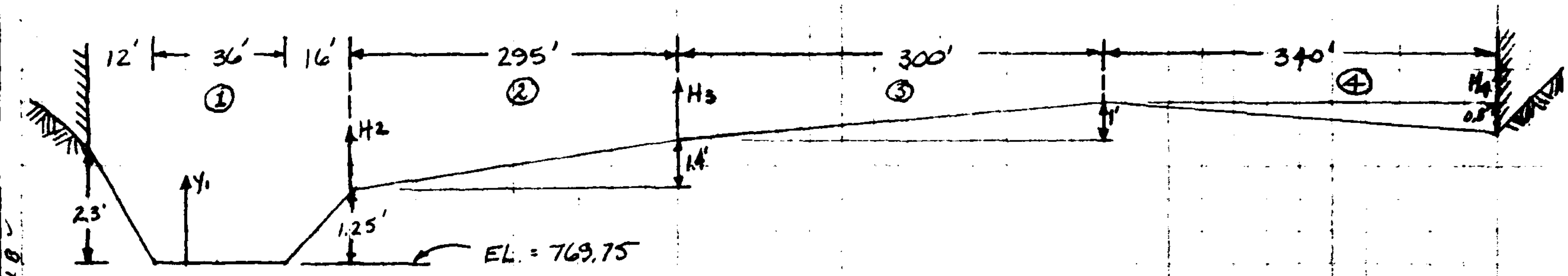


PRC ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. 1 OF 2

PERRY PHILLIPS DAM (MO 10019) JOB NO. 1263

EMERGENCY SPILLWAY AND OVERTOP RATING CURVE BY JFK / KLB DATE 7/1/80



SECTION ①:

at the critical depth section;

for $0 < y \leq 1.25$, $T = 18(2+y)$
$A = y(T - 9y)$

for $1.25 < y \leq 2.3$, $T = 52(1+0.1y)$
$A = y(T - 2.6y) - 10$

for $y > 2.3$, $T = 64$
$A = Ty - 23.8$

at the upstream section, at the dam, y_1 was determined from a backwater analysis using HEC-2

SECTION ②:

$H_2 = W.S.\ EL. - 771$

for $0 < y_2 < 1.4$, $y_2 = 4/5\ H_2$
$T = 210.7\ y_2$
$A = Ty_2/2$

for $1.4 \leq y_2$, $y_2 = 2/3(H_2 + 0.35)$
$T = 295$
$A = Ty_2 - 206.5$

SECTION ③:

$H_3 = H_2 - 1.4$

for $0 < y_3 < 1$, $y_3 = 4/5\ H_3$
$T = 300\ y_3$
$A\ \ Ty_3/2$

for $1 \leq y_3$, $y_3 = 2/3(H_3 + 0.25)$
$T = 300$
$A = Ty_3 - 150$

SECTION ④:

$H_4 = H_3 - 0.2$

for $0 < y_4 < 0.8$, $y_4 = 4/5\ H_4$
$T = 425\ y_4$
$A = Ty_4/2$

for $0.8 \leq y_4$, $y_4 = 2/3(H_4 + 0.2)$
$T = 340$
$A = Ty_4 - 136$

EC-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI – 1980 SHEET NO. 2 OF 2

PERRY PHILLIPS DAM (MO 10019) JOB NO. 1263

EMERGENCY SPILLWAY AND OVERTOP RATING CURVE BY JFK KLB DATE 7/1/80

*HAND CALCULATIONS TO VERIFY DATA FROM HEC 2

y	A	T	$V=\sqrt{\frac{Ag}{T}}$	$Q = VA$	y_1	$S_1 \times 10^{-3}$	A_1	P_1	$V_1 = \frac{1.49}{n} R^{2/3} S^{1/2}$	$V_1^2/2g$	W.S. EL. = $Y_1 + V_1^2/2g + 769.75$	H_2	y_2	T_2	A_2	$Q_2 = \sqrt{\frac{A_2^3 g}{T_2}}$
0.38	14.93	42.82	3.35	50	0.72	20.19	30.72	49.02	1.63	.04	770.51	–				0
0.59	24.27	46.59	4.12	100	1.01	24.56	45.73	54.26	2.19	.07	770.84	–				0
0.77	33.27	49.95	4.66	155	1.26	27.87	69.03	58.51	2.63	.11	771.11	0.11	0.09	18.96	0.85	1.0
0.99	44.36	53.80	5.18	230	1.51	29.27	74.54	59.88	3.09	.15	771.41	0.41	0.33	69.11	11.40	26.3
1.19	55.35	57.36	5.60	310	1.74	30.95	88.52	61.09	3.50	.19	771.68	0.68	0.54	114.62	30.95	91.3
1.37	66.17	59.15	6.05	400	1.97	32.87	102.22	62.25	3.91	.24	771.96	0.96	0.77	161.82	62.90	219.4
1.64	82.48	60.57	6.67	550	2.30	34.87	123.17	64.23	4.47	.31	772.36	1.36	1.09	228.24	124.94	523.4
1.97	102.35	62.26	7.33	750	2.67	36.26	147.32	64.27	5.09	.40	772.82	1.82	1.45	295	221.25	1087.3
2.33	125.09	64.0	7.99	1000	3.08	37.81	173.74	64.27	5.76	.51	773.34	2.34	1.79	295	321.55	1905.0
2.70	149.01	64.0	8.72	1300	3.51	39.94	201.06	64.27	6.47	.65	773.91	2.91	2.17	295	433.65	2983.5
3.16	178.23	64.0	9.54	1700	4.04	41.75	234.50	64.27	7.25	.82	774.60	3.60	2.63	295	570.33	4500.0

*n = 0.027

H_3	y_3	T_3	A_3	$Q_3 = \sqrt{\frac{A_3^3 g}{T_3}}$	H_4	y_4	T_4	A_4	$Q_4 = \sqrt{\frac{A_4^3 g}{T_4}}$	$Q_{TOTAL} = Q + Q_2 + Q_3 + Q_4$
–				0	–				0	50
–				0	–				0	100
–				0	–				0	156
–				0	–				0	256
–				0	–				0	401
–				0	–				0	619
–				0	–				0	1073
0.42	0.34	100.8	17.14	40.1	0.22	0.18	74.8	6.58	11.1	1889
0.94	0.75	225.6	84.83	295.2	0.74	0.59	251.6	74.47	229.9	3429
1.51	1.17	300	202	940.6	1.31	1.01	340	206.26	911.7	6136
2.20	1.63	300	340	2053.9	2.00	1.47	340	362.67	2125.5	10379

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. 1 OF 1

PERRY PHILLIPS DAM (MO. 10019) JOB NO. 1263

CHECK SLOPE IN EMERGENCY SPILLWAY BY JFK DATE 9/16/80

$$Slope_{bed} = 1.6/50 = 0.032$$

$$S_c = \left[\frac{Qn}{1.49}\ \frac{1}{A}\ \frac{1}{R^{2/3}}\right]$$

for $y = 1.0$, $Q = 233.1$
$A = 45.0$
$R = 0.83$

$$S_c = \left[233.1\ \frac{0.03}{1.49}\ \frac{1}{45.0}\ \frac{1}{0.83^{2/3}}\right]^2 = 0.0139 < 0.032 \quad \text{O.K.}$$

for $y = 0.5$, $Q = 77.1$
$A = 20.25$
$R = 0.45$

$$S_c = \left[77.1\ \frac{0.03}{1.49}\ \frac{1}{20.25}\ \frac{1}{0.45^{2/3}}\right]^2 = 0.017 < 0.032 \quad \text{O.K.}$$

∴ The slope of the emergency spillway channel is steep.

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

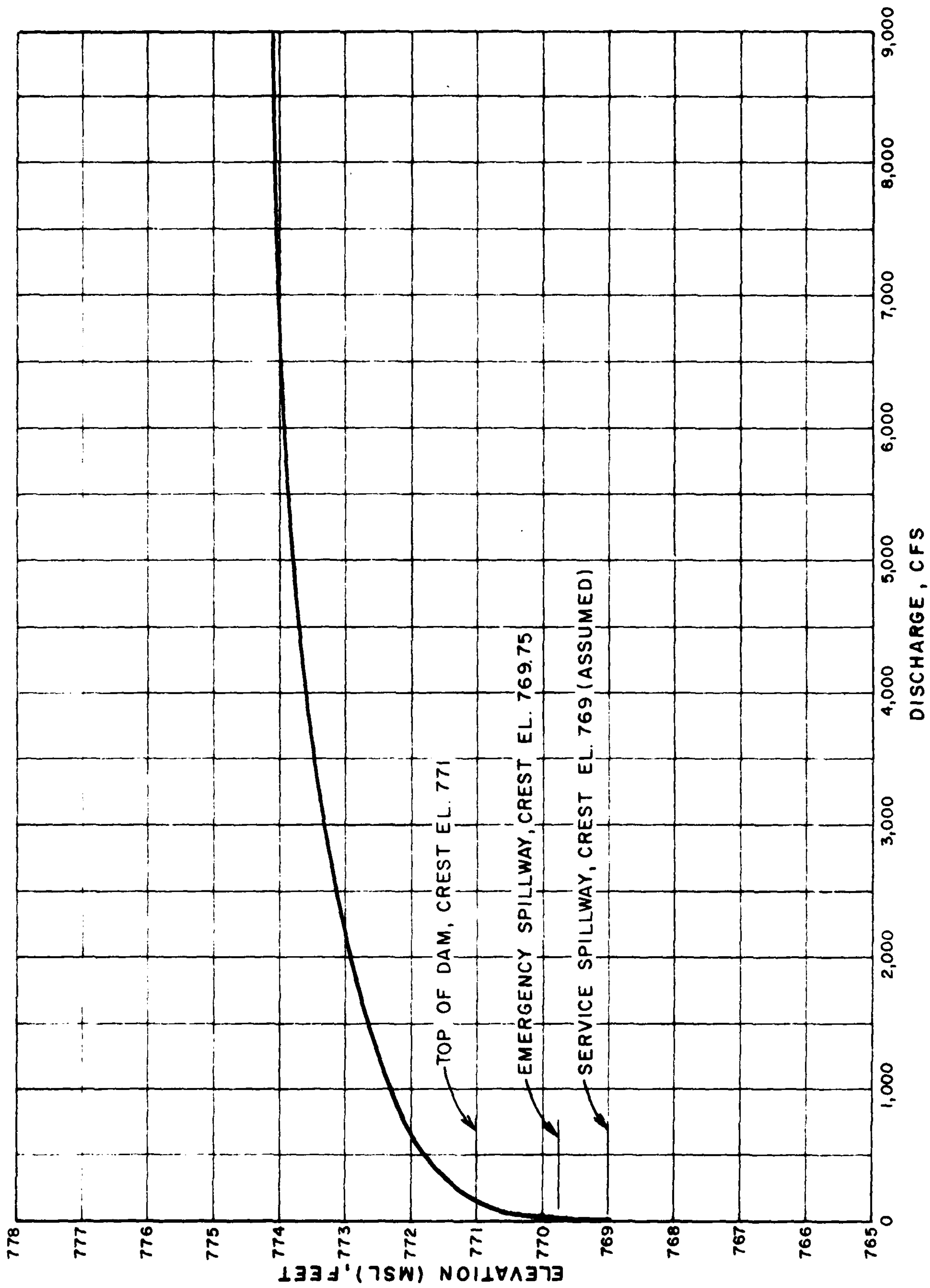
DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. 1 OF 1

PERRY PHILIPS DAM (MO 10019) JOB NO. 1263

COMBINED RATING CURVE BY JFK DATE 7/1/80

W.S. EL.	$Q_{S. SPILLWAY}$	$Q_{OVERTOP}$	Q_{TOTAL}
769	0	0	0
769.25	2.3	0	2.3
769.5	6.4	0	6.4
769.67	9.5	0	9.5
770	11.6	0	11.6
770.51	14.2	50	64
770.84	15.7	100	115
771.11	16.9	156	173
771.41	16.9	256	273
771.68	17.0	401	418
771.96	17.0	619	636
772.36	17.1	1073	1090
772.82	17.2	1889	1906
773.34	17.3	3429	3446
773.91	17.4	6136	6153
774.6	17.5	10379	10397

PLATE 3, APPENDIX B



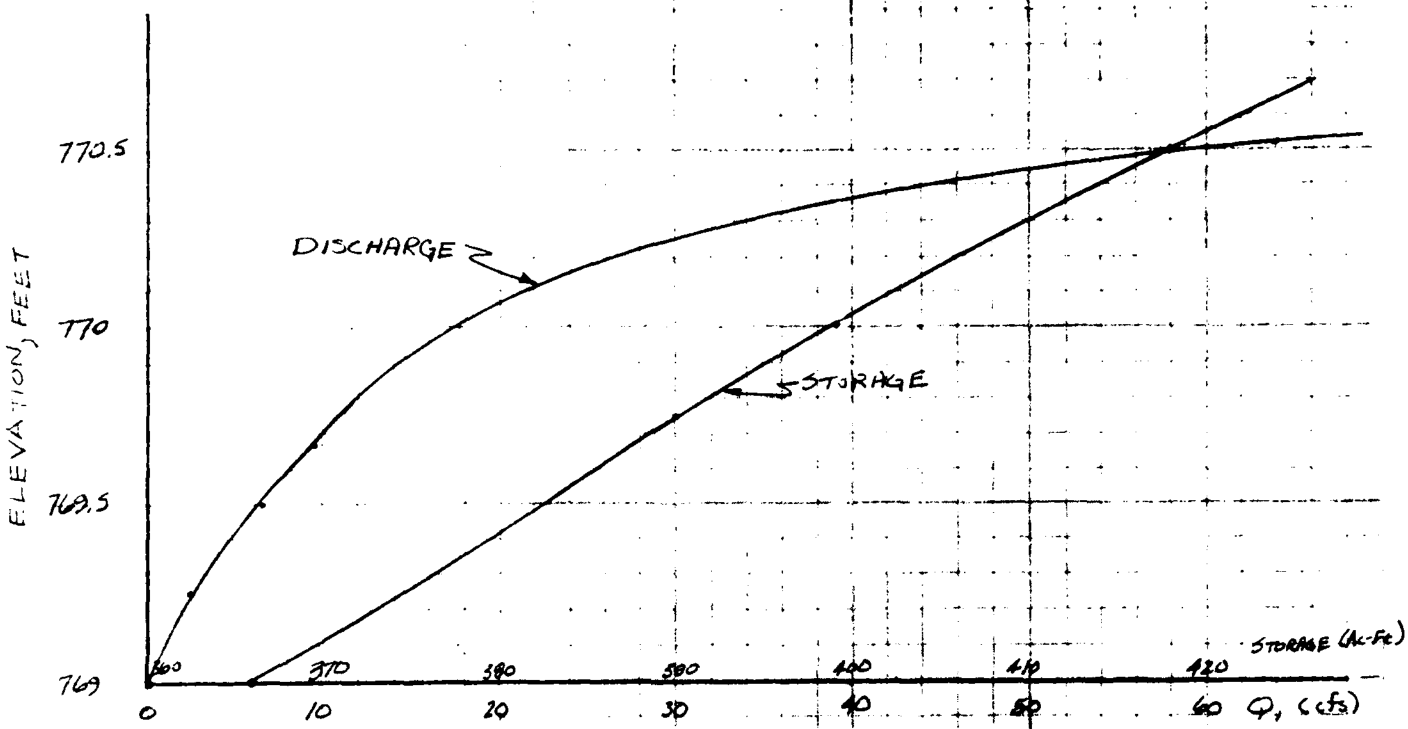
PERRY PHILIPS DAM (MO. 10019)
SPILLWAY AND OVERTOP RATING CURVE

EC-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI - 1980 SHEET NO. 1 OF 1

PERRY PHILIPS DAM (MO. 10019) JOB NO. 1263

STARTING W.S. EL. FOR PMF ROUTING BY JFK DATE 7/3/80



W.S. ELEV$_i$	W.S. ELEV$_f$	Δ STORAGE	Q AVG	Δ TIME	Σ TIME (DAYS)
					1.0
770.6	770.3	12	55	0.11	1.11
770.3	770.	11	26	0.21	1.32
770	769.5	16.5	12	0.69	2.01
769.5	769	16.5	4	2.08	4.09

≈ 4 days

∴ At the end of the 4-day period from the beginning of the antecedent storm, the water surface elevation has returned to the level of the service spillway crest. The PMF routing will start at the service spillway crest elevation.

HEC1DB INPUT DATA

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79
**********************************
  1    A1                      DAM SAFETY INSPECTION - MISSOURI
  2    A2                        PERRY PHILIPS DAM (MO.10019)
  3    A3                        PMF AND 50 PERCENT PMF
  4    B     300       0       5       0       0       0       0       0       0       0
  5    B1      5
  6    J       1       2       1
  7    J1      1      .5
  8    K       0   1 010                                       1
  9    K1  INPUT RUNOFF PARAMETERS
 10    M       1       2     .55             .55       1                       1
 11    P            24.9     105     120     130
 12    T                                                      -1     -93
 13    W            .215
 14    X                       1
 15    K       1   10019                                       1
 16    K1  ROUTE HYDROGRAPH THROUGH PERRY PHILIPS DAM RESERVOIR
 17    Y                               1       1
 18    Y1      1                                            -769      -1
 19    Y4    769  769.25   769.5  769.67     770  770.51  770.54  771.11  771.41  771.69
 20    Y4771.96  772.36  772.82  773.34  773.91   774.6
 21    Y5      0     2.3     6.4     9.5    11.6      64     115     173     273     418
 22    Y5    630    1090    1906    3446    6153   10357
 23    $A      0       2       7      16      31      35    36.5      39      77     132
 24    $E    735     740     750     760     769  769.75     770     771     780     790
 25    $$    769
 26    $D    771
 27    K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 10019
ROUTE HYDROGRAPH TO 10017
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

```
DATE= 80/07/ 2.
TIME= 1 .47.09.

DAM SAFETY INSPECTION - MISSOURI
PERRY PHILLIPS DAM (MO.10019)
PMF AND 50 PERCENT PMF

JOB SPECIFICATION
  NQ    NHR   NMIN   IDAY    IHR   IMIN  METRC   IPLT   IPRT  NSTAN
 300      0      5      0      0      0      0      0      0      0
                    JOPER    NWT  LROPT  TRACE
                        5      0      0      0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS=   1.00    .50

SUB-AREA RUNOFF COMPUTATION

INPUT RUNOFF PARAMETERS
ISTAQ  ICOMP  IECON  ITAPE  JPLT  JPRT  INAME  ISTAGE  IAUTO
10019      0      0      0     0     0      1       2      0

HYDROGRAPH DATA
IHYDG  IUHG  TAREA  SNAP  TRSDA  TRSPC  RATIO  ISNOW  ISAME  LOCAL
                               1.00   0.000      0      1      0

PRECIP DATA
SPFE  PMS  R6  R12  R24  R48  R72  R96

LOSS DATA
LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP

UNIT HYDROGRAPH DATA
LAG

RECESSION DATA
STRTQ  QRCSN  RTIOR

UNIT HYDROGRAPH 15 END OF PERIOD ORDINATES, TC=  0.00 HOURS, LAG=
```

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.21	.21	.00	837.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.21	.21	.00	853.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.21	.21	.00	863.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.21	.21	.00	868.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.21	.21	.00	872.
1.01	.30	[illegible]	.01	0.00	.01	0.	1.01	13.00	156	.21	.21	.00	874.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.25	.25	.00	889.
1.01	.40	8	.01	0.00	.01	[illegible]	1.01	13.10	158	.25	.25	.00	918.
1.01	.45	[illegible]	.01	0.00	.01	0.	1.01	13.15	159	.25	.25	.00	961.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.25	.25	.00	998.
1.01	.55	11	.01	.00	.01	0.	1.01	13.25	161	.25	.25	.00	1021.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	162	.25	.25	.00	1035.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	163	.25	.25	.00	1043.
1.01	1.10	14	.01	.00	.01	1.	1.01	13.40	164	.25	.25	.00	1049.
1.01	1.15	15	.01	.00	.01	2.	1.01	13.45	165	.25	.25	.00	1051.
1.01	1.20	16	.01	.00	.01	4.	1.01	13.50	166	.25	.25	.00	1053.
1.01	1.25	17	.01	.00	.01	5.	1.01	13.55	167	.25	.25	.00	1054.
1.01	1.30	18	.01	.00	.01	7.	1.01	14.00	168	.25	.25	.00	1055.
1.01	1.35	19	.01	.00	.01	9.	1.01	14.05	169	.31	.31	.00	1069.
1.01	1.40	20	.01	.00	.01	10.	1.01	14.10	170	.31	.31	.00	1117.
1.01	1.45	21	.01	.00	.01	12.	1.01	14.15	171	.31	.31	.00	1182.
1.01	1.50	22	.01	.00	.01	13.	1.01	14.20	172	.31	.31	.00	1227.
1.01	1.55	23	.01	.00	.01	15.	1.01	14.25	173	.31	.31	.00	1272.
1.01	2.00	24	.01	.00	.01	16.	1.01	14.30	174	.31	.31	.00	1292.
1.01	2.05	25	.01	.00	.01	18.	1.01	14.35	175	.31	.31	.00	1304.
1.01	2.10	26	.01	.01	.01	19.	1.01	14.40	176	.31	.31	.00	1311.
1.01	2.15	27	.01	.01	.01	20.	1.01	14.45	177	.31	.31	.00	1315.
1.01	2.20	28	.01	.01	.01	21.	1.01	14.50	178	.31	.31	.00	1318.
1.01	2.25	29	.01	.01	.01	22.	1.01	14.55	179	.31	.31	.00	1320.
1.01	2.30	30	.01	.01	.01	23.	1.01	15.00	180	.31	.31	.00	1321.
1.01	2.35	31	.01	.01	.01	24.	1.01	15.05	181	.19	.19	.00	1294.
1.01	2.40	32	.01	.01	.01	25.	1.01	15.10	182	[illegible]	[illegible]	.00	1244.
1.01	2.45	33	.01	.01	.01	26.	1.01	15.15	183	.38	.38	.00	1263.
1.01	2.50	34	.01	.01	.01	27.	1.01	15.20	184	.57	.57	.00	[illegible]
1.01	2.55	35	.01	.01	.01	28.	1.01	15.25	185	.66	.66	.00	1660.
1.01	3.00	36	.01	.01	.01	29.	1.01	[illegible]	186	1.61	1.61	.00	2210.
1.01	3.05	37	.01	.01	.01	29.	1.01	15.35	187	2.65	2.65	.00	3474.
1.01	3.10	38	.01	.01	.01	30.	1.01	15.40	188	1.04	1.04	.00	5090.
[illegible]	3.15	[illegible]	.01	.01	.01	31.	1.01	15.45	189	.66	.66	.00	[illegible]
[illegible]	3.20	[illegible]	.01	.01	[illegible]	32.	1.01	15.50	190	.57	[illegible]	[illegible]	[illegible]
1.01	[illegible]	[illegible]	.01	.01	[illegible]	32.	1.01	15.55	191	.38	.38	[illegible]	[illegible]
[illegible]	3.30	[illegible]	.01	.01	[illegible]	33.	[illegible]	16.00	192	[illegible]	.38	[illegible]	[illegible]
[illegible]	3.35	[illegible]	.01	.01	.01	34.	1.01	16.05	193	.29	.29	[illegible]	[illegible]
[illegible]	3.40	[illegible]	[illegible]	.01	.01	34.	1.01	16.10	194	.29	.29	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.01	16.15	[illegible]	.29	.29	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.01	[illegible]	35.	1.01	16.20	[illegible]	.29	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	.01	[illegible]	36.	1.01	16.25	[illegible]	.29	[illegible]	[illegible]	[illegible]
1.01	4.00	[illegible]	.01	.01	.00	36.	1.01	16.30	[illegible]	.29	.29	[illegible]	[illegible]
1.01	4.05	[illegible]	.01	.01	.00	37.	1.01	16.35	199	.29	.29	[illegible]	[illegible]
[illegible]	4.10	[illegible]	.01	.01	.00	37.	1.01	16.40	200	.29	.29	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.01	.01	.00	[illegible]	1.01	[illegible]	[illegible]	.29	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.01	.01	.00	38.	1.01	16.50	[illegible]	.29	.29	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.55	203	.29	.29	[illegible]	[illegible]
[illegible]	4.30	[illegible]	.01	.01	.00	39.	1.01	17.00	[illegible]	.29	.29	[illegible]	[illegible]
1.01	4.35	[illegible]	.01	.01	.00	40.	1.01	17.05	205	.23	.23	[illegible]	[illegible]
1.01	[illegible]	[illegible]	.01	.01	.00	40.	1.01	17.10	206	.23	[illegible]	.00	[illegible]

1.01	4.45	57	.01	.01	.00	40.	1.01	17.15	207	.23	.23	.00	1110.
1.01	4.50	58	.01	.01	.00	41.	1.01	17.20	208	.23	.23	.00	1054.
1.01	4.55	59	.01	.01	.00	41.	1.01	17.25	209	.23	.23	.00	1019.
1.01	5.00	60	.01	.01	.00	41.	1.01	17.30	210	.23	.23	.00	1000.
1.01	5.05	61	.01	.01	.00	42.	1.01	17.35	211	.23	.23	.00	988.
1.01	5.10	62	.01	.01	.00	42.	1.01	17.40	212	.23	.23	.00	981.
1.01	5.15	63	.01	.01	.00	42.	1.01	17.45	213	.23	.23	.00	977.
1.01	5.20	64	.01	.01	.00	43.	1.01	17.50	214	.23	.23	.00	974.
1.01	5.25	65	.01	.01	.00	43.	1.01	17.55	215	.23	.23	.00	973.
1.01	5.30	66	.01	.01	.00	43.	1.01	18.00	216	.23	.23	.00	972.
1.01	5.35	67	.01	.01	.00	44.	1.01	18.05	217	.02	.02	.00	924.
1.01	5.40	68	.01	.01	.00	44.	1.01	18.10	218	.02	.02	.00	765.
1.01	5.45	69	.01	.01	.00	44.	1.01	18.15	219	.02	.02	.00	550.
1.01	5.50	70	.01	.01	.00	44.	1.01	18.20	220	.02	.02	.00	365.
1.01	5.55	71	.01	.01	.00	45.	1.01	18.25	221	.02	.02	.00	249.
1.01	6.00	72	.01	.01	.00	45.	1.01	18.30	222	.02	.02	.00	184.
1.01	6.05	73	.07	.05	.01	55.	1.01	18.35	223	.02	.02	.00	144.
1.01	6.10	74	.07	.06	.01	59.	1.01	18.40	224	.02	.02	.00	121.
1.01	6.15	75	.07	.06	.01	130.	1.01	18.45	225	.02	.02	.00	107.
1.01	6.20	76	.07	.06	.01	177.	1.01	18.50	226	.02	.02	.00	99.
1.01	6.25	77	.07	.06	.01	204.	1.01	18.55	227	.02	.02	.00	94.
1.01	6.30	78	.07	.05	.01	222.	1.01	19.00	228	.02	.02	.00	91.
1.01	6.35	79	.07	.06	.01	233.	1.01	19.05	229	.02	.02	.00	90.
1.01	6.40	80	.07	.06	.01	242.	1.01	19.10	230	.02	.02	.00	89.
1.01	6.45	81	.07	.06	.01	247.	1.01	19.15	231	.02	.02	.00	89.
1.01	6.50	82	.07	.06	.01	252.	1.01	19.20	232	.02	.02	.00	88.
1.01	6.55	83	.07	.06	.01	255.	1.01	19.25	233	.02	.02	.00	88.
1.01	7.00	84	.07	.06	.01	258.	1.01	19.30	234	.02	.02	.00	88.
1.01	7.05	85	.07	.06	.01	261.	1.01	19.35	235	.02	.02	.00	86.
1.01	7.10	86	.07	.06	.01	263.	1.01	19.40	236	.02	.02	.00	88.
1.01	7.15	87	.07	.06	.01	265.	1.01	19.45	237	.02	.02	.00	88.
1.01	7.20	88	.07	.06	.01	267.	1.01	19.50	238	.02	.02	.00	88.
1.01	7.25	89	.07	.06	.01	268.	1.01	19.55	239	.02	.02	.00	88.
1.01	7.30	90	.07	.06	.00	270.	1.01	20.00	240	.02	.02	.00	88.
1.01	7.35	91	.07	.06	.00	271.	1.01	20.05	241	.02	.02	.00	88.
1.01	7.40	92	.07	.06	.00	272.	1.01	20.10	242	.02	.02	.00	88.
1.01	7.45	93	.07	.06	.00	273.	1.01	20.15	243	.02	.02	.00	88.
1.01	7.50	94	.07	.07	.00	274.	1.01	20.20	244	.02	.02	.00	88.
1.01	7.55	95	.07	.07	.00	275.	1.01	20.25	245	.02	.02	.00	88.
1.01	8.00	96	.07	.07	.00	275.	1.01	20.30	246	.02	.02	.00	56.
1.01	8.05	97	.07	.07	.00	277.	1.01	20.35	247	.02	.02	.00	88.
1.01	8.10	98	.07	.07	.00	278.	1.01	20.40	248	.02	.02	.00	88.
1.01	8.15	99	.07	.07	.00	278.	1.01	20.45	249	.02	.02	.00	88.
1.01	[illegible]	[illegible]	.07	.07	.00	279.	1.01	20.50	250	.02	.02	.00	88.
1.01	8.25	[illegible]	.07	.07	.00	280.	1.01	20.55	251	.02	[illegible]	[illegible]	[illegible]
1.01	8.30	102	.07	.07	.00	280.	1.01	21.00	252	.02	.02	.00	[illegible]
1.01	8.35	103	.07	.07	.00	281.	1.01	21.05	253	.02	.02	.00	88.
1.01	8.40	104	.07	.07	.00	281.	1.01	21.10	254	.02	.02	.00	88.
1.01	[illegible]	[illegible]	[illegible]	.07	.00	282.	1.01	21.15	255	.02	.02	.00	88.
1.01	[illegible]	[illegible]	.07	.07	.00	282.	1.01	21.20	256	.02	[illegible]	[illegible]	88.
1.01	[illegible]	[illegible]	[illegible]	.07	.00	283.	1.01	21.25	257	.02	[illegible]	[illegible]	88.
1.01	9.00	[illegible]	.07	.07	.00	283.	1.01	21.30	258	.02	.02	.00	88.
1.01	9.05	109	.07	.07	.00	284.	1.01	21.35	259	.02	.02	.00	88.
1.01	9.10	110	.07	.07	.00	284.	1.01	21.40	260	.02	.02	.00	88.
1.01	9.15	111	.07	.07	.00	284.	1.01	21.45	261	.02	.02	.00	88.
1.01	9.20	112	.07	.07	.00	284.	1.01	21.50	262	.02	.02	.00	88.
1.01	9.25	113	.07	.07	.00	284.	1.01	21.55	263	.02	.02	.00	88.
1.01	9.30	114	.07	.07	.00	285.	1.01	22.00	264	.02	.02	.00	88.
1.01	9.35	115	.07	.07	.00	286.	1.01	22.05	265	.02	.02	.00	88.
1.01	9.40	116	.07	.07	.00	28[illegible].	1.01	22.10	266	.02	.02	.00	88.

1.01	9.45	117	.07	.07	.00	286.	1.01	22.15	267	.02	[illegible]	.00	88.
1.01	9.50	118	[illegible]	.07	.00	286.	1.01	22.20	[illegible]	.02	.02	.00	88.
1.01	9.55	119	.07	.07	.00	287.	1.01	22.25	269	.02	.02	.00	88.
1.01	10.00	120	.07	.07	.00	287.	1.01	22.30	270	.02	.02	.00	88.
1.01	[illegible]	121	.07	.07	.00	287.	1.01	22.35	271	.02	.02	.00	88.
1.01	10.10	122	.07	[illegible]	.00	287.	1.01	22.40	272	.02	.02	.00	88.
1.01	10.15	123	.07	[illegible]	.00	287.	1.01	22.45	273	.02	.02	.00	88.
1.01	10.20	124	.07	.07	.00	288.	1.01	22.50	274	.02	.02	.00	88.
1.01	10.25	125	.07	.07	.00	288.	1.01	22.55	275	.02	.02	.00	88.
1.01	10.30	126	.07	.07	[illegible]	288.	1.01	23.00	276	.02	.02	.00	88.
1.01	[illegible]	127	.07	.07	.00	288.	1.01	23.05	277	.02	.02	.00	88.
1.01	10.40	128	.07	.07	.00	288.	1.01	23.10	278	.02	.02	.00	88.
1.01	10.45	129	.07	.07	.00	288.	1.01	23.15	279	.02	.02	.00	88.
1.01	10.50	130	.07	.07	.00	289.	1.01	23.20	280	.02	.02	.00	88.
1.01	[illegible]	131	.07	.07	.00	289.	1.01	23.25	[illegible]	.02	.02	.00	88.
1.01	11.00	132	.07	.07	.00	289.	1.01	23.30	282	.02	.02	.00	88.
1.01	11.05	133	.07	.07	.00	289.	1.01	23.35	283	.02	.02	.00	88.
1.01	11.10	134	.07	.07	.00	289.	1.01	23.40	284	.02	.02	.00	88.
1.01	11.15	135	.07	.07	.00	289.	1.01	23.45	285	.02	.02	.00	88.
1.01	11.20	136	.07	.07	.00	289.	1.01	23.50	286	.02	.02	.00	88.
1.01	11.25	137	.07	.07	.00	290.	1.01	23.55	287	.02	.02	.00	88.
1.01	11.30	138	.07	.07	.00	290.	1.02	0.00	288	.02	.02	.00	88.
1.01	11.35	139	.07	.07	.00	290.	1.02	.05	[illegible]	.00	0.00	0.00	88.
1.01	11.40	140	.07	.07	.00	290.	1.02	.10	290	0.00	0.00	0.00	68.
1.01	11.45	141	.07	.07	.00	290.	1.02	.15	291	0.00	0.00	0.00	46.
1.01	11.50	142	.07	.07	.00	290.	1.02	.20	292	0.00	0.00	0.00	28.
1.01	11.55	143	.07	.07	.00	290.	1.02	.25	293	0.00	0.00	0.00	16.
1.01	12.00	144	.07	.07	.00	293.	1.02	.30	294	0.00	0.00	0.00	10.
1.01	12.05	145	.21	.20	.00	321.	1.02	.35	295	0.00	0.00	0.00	6.
1.01	12.10	146	.21	.21	.00	426.	1.02	.40	296	0.00	0.00	0.00	3.
1.01	12.15	147	.21	.21	.00	568.	1.02	.45	297	0.00	0.00	0.00	2.
1.01	12.20	148	.21	.21	.00	690.	1.02	.50	298	0.00	0.00	0.00	1.
1.01	12.25	149	.21	.21	.00	767.	1.02	.55	299	0.00	0.00	0.00	1.
1.01	12.30	150	.21	.21	.00	811.	1.02	1.00	300	0.00	0.00	0.00	0.

SUM 32.37 31.48 .89 1340151.
(822.)(800.)(23.)(37948.)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6824.	1463.	465.	447.	134027.
CMS	193.	41.	13.	13.	3795.
INCHES		24.57	31.48	31.48	31.48
MM		624.17	799.69	799.69	799.69
AC-FT		2730.	923.	923.	923.
THOUS CU M		889.	1139.	1139.	1139.

HYDROGRAPH AT STA [illegible] FOR [illegible]

[illegible]	35.	35.	36.	36.	37.	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	285.	288.	288.	286.	286.	288.	[illegible]	287.	287.
[illegible]	267.	287.	288.	288.	288.	388.	288.	288.	289.
[illegible]	[illegible]	288.	289.	289.	269.	290.	290.	290.	290.
[illegible]	[illegible]	270.	[illegible]	371.	426.	560.	670.	767.	811.
[illegible]	[illegible]	863.	868.	872.	874.	885.	916.	961.	998.
[illegible]	1035.	1047.	1048.	1051.	1052.	1054.	1055.	1069.	1117.
[illegible]	1237.	1272.	1292.	1784.	1711.	1315.	1318.	1320.	1321.
[illegible]	1244.	1263.	1392.	1660.	2210.	1474.	5096.	5824.	5380.
[illegible]	3403.	2723.	2173.	1825.	1566.	1442.	1358.	1308.	1276.
[illegible]	1244.	1239.	1257.	1222.	1174.	1110.	1054.	1019.	1006.
[illegible]	981.	977.	974.	973.	972.	924.	765.	550.	365.
[illegible]	184.	144.	121.	107.	99.	94.	91.	90.	89.
46.	88.	88.	88.	88.	88.	88.	88.	88.	88.
88.	88.	88.	88.	88.	88.	88.	[illegible]	88.	88.
88.	88.	[illegible]	88.	88.	88.	88.	88.	88.	88.
[illegible]	55.	[illegible]	78.	[illegible]	58.	88.	88.	88.	88.
[illegible]	86.	[illegible]	68.	[illegible]	86.	68.	59.	[illegible]	89.
[illegible]	[illegible]	88.	25.	84.	68.	18.	38.	54.	68.
46.	[illegible]	16.	10.	5.	3.	2.	1.	1.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	50248.	1453.	465.	447.	134027.
CMS	1[illegible]5.	41.	13.	13.	3795.
INCHES		24.57	31.44	31.46	31.46
MM		624.17	799.69	799.69	799.69
AC-FT		720.	923.	923.	923.
THOUS CU M		889.	1139.	1139.	1139.

HYDROGRAPH AT STA 10019 FOR PLAN 1, RTIO 2

[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	[illegible]
0.	0.	0.	1.	1.	2.	[illegible]	4.	4.	5.
[illegible]	7.	7.	8.	9.	9.	10.	11.	11.	[illegible]
12.	13.	13.	14.	14.	14.	15.	15.	15.	16.
16.	16.	17.	17.	17.	18.	18.	18.	19.	19.
19.	19.	19.	20.	20.	20.	20.	20.	21.	21.
21.	21.	21.	21.	22.	22.	22.	22.	22.	22.
[illegible]	22.	[illegible]	45.	68.	89.	102.	111.	117.	[illegible]
124.	126.	128.	129.	130.	132.	133.	136.	138.	[illegible]
135.	136.	137.	137.	138.	138.	[illegible]	139.	139.	139.
140.	140.	140.	141.	141.	141.	141.	142.	142.	142.
142.	142.	142.	[illegible]	143.	143.	143.	143.	143.	[illegible]
[illegible]	144.	144.	144.	144.	144.	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	145.	145.	145.	145.	[illegible]	146.	[illegible]	146.
[illegible]	145.	145.	[illegible]	161.	218.	284.	[illegible]	383.	405.
[illegible]	427.	431.	434.	436.	487.	[illegible]	459.	480.	[illegible]
[illegible]	[illegible]	521.	524.	525.	524.	[illegible]	627.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	830.	1100.	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	721.	679.	[illegible]	[illegible]
[illegible]	[illegible]	520.	[illegible]	[illegible]	[illegible]	[illegible]	527.	519.	[illegible]
[illegible]	[illegible]	[illegible]	487.	486.	486.	482.	382.	278.	[illegible]
129.	98.	72.	60.	534.	49.	47.	46.	45.	[illegible]
44.	44.	[illegible]	[illegible]	[illegible]	44.	44.	44.	44.	[illegible]
44.	44.	44.	[illegible]	[illegible]	44.	44.	44.	44.	[illegible]
44.	44.	44.	[illegible]	44.	44.	44.	44.	44.	[illegible]
44.	44.	44.	44.	44.	44.	44.	44.	44.	[illegible]
[illegible]	44.	44.	44.	44.	44.	44.	44.	42.	[illegible]

PMF AND ONE-HALF PMF ROUTING

```
   23.     14.      8.      5.      3.      2.      1.      1.      0.      0.

                   PEAK   [illegible]  24-HOUR  72-HOUR  TOTAL VOLUME
      [illegible] 2412.   [illegible]    22[illegible].   22[illegible].   6701[illegible].
      [illegible]   2[illegible].    2[illegible].      7.       6.     1[illegible]98.
       INCHES             [illegible]   15.74  [illegible].74   1[illegible].7[illegible]
      [illegible]             [illegible].99  39[illegible].6[illegible]  399.6[illegible]   399.[illegible]
       AC-FT               36[illegible].   4[illegible].    462.     4[illegible]2.
   THOUS CU M              44[illegible].   [illegible].    569.     [illegible]69.

**********    **********    **********    **********    **********

                          HYDROGRAPH ROUTING

      ROUTE HYDROGRAPH THRO[illegible] [illegible]Y PHILIP[illegible] DAM RESERVOIR

           ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
           1[illegible]1[illegible]       1       0       [illegible]       0       [illegible]       1       0       [illegible]
                                 ROUTING DATA
    [illegible]   CLOSS     AVG    IRES   ISAME   IOPT    IPMP            LSTR
      [illegible]   [illegible]   [illegible]       1       1       0       [illegible]               [illegible]

           NSTPS   NSTDL     LAG   AMSKK       X     TSK    STORA  ISPRAT
              1       [illegible]       0  [illegible]   [illegible]   [illegible]   -7[illegible].      -1

STAGE  7[illegible]   7[illegible]   7[illegible]   7[illegible].67   7[illegible]   77[illegible]   77[illegible]   771.11   771.[illegible]   771.6[illegible]
       [illegible]1.9   7[illegible].35   772.[illegible]   772.[illegible]   772.[illegible]   774.[illegible]

FLOW   [illegible]   2.30   [illegible]   [illegible].50   11.[illegible]   [illegible]   11[illegible]   175.00   273.00   418.00
       [illegible]   [illegible].00   1[illegible].0[illegible]   [illegible]45.00   6157.00   1[illegible]397.[illegible]

SURFACE AREA=     0.     2.     [illegible].     1[illegible].     31.     3[illegible].     [illegible]7.     37.     77.     132.

   CAPACITY=     0.     3.     4[illegible].     1[illegible].     36[illegible].     370.     395.     [illegible]37.     [illegible]43.     1962.

  ELEVATION=     [illegible].     74[illegible].     750.     760.     769.     770.     77[illegible].     771.     780.     7[illegible]0.

           CREL   SPWID   COQW   EXPW   ELEVL   COQL   CAREA    EXPL
          769.0     0.0    0.0    0.0     0.0     0.      0.0      0.

                               DAM DATA
                    TOPEL    COQD   EXPD   DAMWID
                    771.0     0.0    0.0       0.

              STATION 10514, PLAN 1, RATIO 1

              END-OF-PERIOD HYDROGRAPH ORDINATES

                               OUTFLOW
   [illegible]    0.     0.     0.     0.     0.     0.     0.     0.     0.
   0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
   0.     0.     0.     0.     0.     0.     0.     0.     0.     0.
   1.     1.     1.     1.     1.     1.     1.     1.     1.     1.
```

AD-A104 621 CONSOER TOWNSEND AND ASSOCIATES LTD ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. PERRY PHILIPS DAM (MO10019) MISSOU--ETC(U)
SEP 80 W G SHIFRIN DACW43-80-C-0094

UNCLASSIFIED NL

2 OF 2
AD
A104621

END
DATE
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DTIC

END
DATE
FILMED
10-81
DTIC

[illegible]	1.	1.	1.	1.	1.	1.	1.	2.	2.
[illegible]	[illegible]	2.	[illegible]	[illegible]	2.	2.	2.	2.	2.
3.	2.	3.	[illegible]	3.	3.	3.	3.	4.	4.
[illegible]	4.	4.	4.	5.	5.	6.	7.	7.	8.
[illegible]	10.	10.	[illegible]	11.	11.	11.	12.	15.	20.
[illegible]	32.	34.	[illegible]	[illegible]	[illegible]	[illegible]	56.	60.	64.
76.	[illegible]	[illegible]	87.	93.	98.	[illegible]	100.	112.	118.
124.	[illegible]	[illegible]	141.	147.	152.	157.	162.	[illegible]	171.
[illegible]	182.	[illegible]	194.	[illegible]	204.	209.	213.	217.	221.
[illegible]	[illegible]	[illegible]	235.	238.	241.	244.	246.	249.	251.
[illegible]	[illegible]	257.	[illegible]	201.	[illegible]	284.	314.	350.	388.
[illegible]	[illegible]	324.	[illegible]	[illegible]	633.	677.	711.	749.	787.
[illegible]	938.	687.	913.	[illegible]	954.	971.	994.	997.	1012.
[illegible]	1065.	1092.	1141.	1179.	1210.	[illegible]	1255.	1270.	1282.
[illegible]	[illegible]	1276.	[illegible]	1745.	1487.	1811.	1656.	3743.	4694.
4777.	4221.	3693.	[illegible]	[illegible]	2363.	[illegible]	1853.	[illegible]	1125.
[illegible]	1471.	1415.	1374.	[illegible]	[illegible]	[illegible]	1222.	1177.	1157.
1102.	1073.	[illegible]	1349.	[illegible]	[illegible]	1017.	986.	933.	854.
[illegible]	671.	[illegible]	744.	493.	[illegible]	436.	381.	[illegible]	353.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	245.	[illegible]	229.	221.	213.
[illegible]	[illegible]	193.	[illegible]	[illegible]	177.	[illegible]	169.	166.	163.
[illegible]	158.	[illegible]	[illegible]	[illegible]	148.	[illegible]	149.	142.	140.
[illegible]	126.	124.	[illegible]	133.	129.	129.	126.	125.	123.
[illegible]	121.	126.	[illegible]	[illegible]	116.	115.	114.	114.	113.
[illegible]	112.	111.	[illegible]	110.	[illegible]	[illegible]	135.	108.	137.
[illegible]	127.	121.	[illegible]	[illegible]	94.	[illegible]	89.	85.	84.

[illegible]

[illegible]	366.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	366.
[illegible]	[illegible]	366.	[illegible]	[illegible]	366.	[illegible]	[illegible]	[illegible]	366.
[illegible]	[illegible]	[illegible]	[illegible]	366.	366.	367.	367.	367.	367.
[illegible]	367.	367.	[illegible]	368.	368.	[illegible]	369.	369.	369.
[illegible]	369.	369.	370.	[illegible]	370.	370.	371.	371.	371.
371.	372.	372.	372.	372.	373.	373.	373.	373.	374.
[illegible]	[illegible]	374.	375.	375.	[illegible]	375.	376.	376.	376.
377.	377.	377.	378.	[illegible]	380.	381.	382.	384.	385.
387.	[illegible]	390.	392.	394.	395.	397.	[illegible]	401.	402.
404.	406.	407.	409.	411.	[illegible]	414.	415.	417.	418.
420.	421.	423.	424.	425.	[illegible]	428.	429.	430.	431.
432.	433.	435.	436.	[illegible]	437.	[illegible]	439.	443.	441.
442.	442.	443.	444.	[illegible]	[illegible]	446.	446.	447.	447.
[illegible]	448.	[illegible]	[illegible]	449.	449.	450.	450.	456.	451.
451.	451.	451.	452.	452.	453.	[illegible]	456.	459.	482.
465.	458.	470.	472.	479.	476.	477.	479.	[illegible]	482.
[illegible]	484.	486.	487.	497.	488.	[illegible]	489.	490.	[illegible]
[illegible]	392.	[illegible]	495.	[illegible]	496.	497.	497.	490.	498.
[illegible]	498.	495.	475.	500.	505.	511.	526.	541.	551.
[illegible]	547.	541.	534.	527.	[illegible]	[illegible]	513.	509.	587.
[illegible]	503.	[illegible]	500.	500.	499.	490.	497.	495.	[illegible]
[illegible]	493.	492.	492.	491.	491.	490.	499.	487.	[illegible]
[illegible]	471.	[illegible]	471.	468.	[illegible]	[illegible]	461.	460.	456.
[illegible]	[illegible]	[illegible]	[illegible]	451.	450.	[illegible]	448.	447.	448.
445.	444.	444.	443.	[illegible]	[illegible]	441.	441.	440.	439.
[illegible]	[illegible]	436.	435.	437.	437.	[illegible]	436.	436.	435.
435.	[illegible]	434.	434.	434.	433.	433.	433.	433.	432.
432.	432.	432.	431.	431.	431.	431.	431.	430.	430.
430.	430.	430.	430.	429.	429.	429.	429.	429.	429.
[illegible]	428.	427.	427.	426.	[illegible]	[illegible]	424.	424.	425.

STAGE

769.0	[illegible]	769.0	769.0	769.0	769.0	769.0	[illegible]	769.0	769.0
769.0	[illegible]	769.0	769.0	769.0	769.0	769.0	769.0	769.0	769.0
769.0	[illegible]	769.0	769.0	769.0	769.0	769.0	[illegible]	769.0	769.0
769.1	[illegible]	769.1	769.1	[illegible]	769.1	769.1	769.1	769.1	769.1
[illegible]	769.1	769.1	769.1	769.1	769.1	[illegible]	[illegible]	769.2	769.2
[illegible]	[illegible]	769.2	[illegible]	769.2	[illegible]	[illegible]	769.3	769.2	769.3
[illegible]	[illegible]	769.3	[illegible]	769.3	769.3	769.3	769.3	769.3	[illegible]
[illegible]	769.4	769.4	769.4	769.4	[illegible]	769.5	[illegible]	[illegible]	769.6
[illegible]	[illegible]	769.7	[illegible]	769.8	769.9	[illegible]	[illegible]	770.0	770.1
770.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.4	770.4	770.5	770.5
[illegible]	[illegible]	[illegible]	770.7	[illegible]	770.7	[illegible]	[illegible]	[illegible]	773.9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	771.0	[illegible]	771.1	771.1	771.1
771.1	771.1	[illegible]	771.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	771.3
[illegible]	[illegible]	771.3	[illegible]	771.3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	771.4	771.3	771.4	771.4	[illegible]	[illegible]	[illegible]	771.5
771.7	[illegible]	[illegible]	[illegible]	[illegible]	772.0	[illegible]	[illegible]	[illegible]	772.1
772.1	[illegible]	[illegible]	[illegible]	[illegible]	772.2	[illegible]	[illegible]	772.3	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	772.4	772.4	772.4	772.5	[illegible]	[illegible]
772.5	[illegible]	[illegible]	[illegible]	772.5	[illegible]	[illegible]	773.1	772.4	773.6
772.6	773.5	773.4	773.3	773.1	[illegible]	[illegible]	[illegible]	772.7	[illegible]
772.6	[illegible]	[illegible]	[illegible]	772.5	772.5	[illegible]	[illegible]	772.4	772.4
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	772.2	772.2
[illegible]	[illegible]	[illegible]	[illegible]	771.9	[illegible]	771.7	[illegible]	[illegible]	771.5
[illegible]	[illegible]	771.4	771.4	771.4	[illegible]	[illegible]	771.3	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	771.1	771.1	771.1	771.1	771.1	771.1
771.1	[illegible]	[illegible]	[illegible]	[illegible]	771.0	[illegible]	[illegible]	[illegible]	771.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.8	[illegible]	[illegible]	770.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.8
[illegible]	[illegible]	[illegible]	770.7	770.7	770.7	[illegible]	[illegible]	770.7	770.6

PEAK OUTFLOW IS 4777. AT TIME [illegible] HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4777.	1411.	436.	[illegible]	125642.
CMS	135.	40.	12.	12.	3558.
INCHES		[illegible]	29.51	29.51	29.51
MM		[illegible]	749.66	749.66	749.66
AC-FT		[illegible]	865.	865.	865.
THOUS CU M		[illegible]	1067.	1067.	1067.

STATION 100194 PLAN 1, RATIO [illegible]

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	0.	0.	0.	0.	0.	0.	0.	0.	0.
[illegible]	[illegible]	[illegible]	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
[illegible]	[illegible]	1.	1.	1.	1.	[illegible]	1.	1.	[illegible]
[illegible]	[illegible]	1.	1.	1.	1.	1.	2.	2.	[illegible]
[illegible]	[illegible]	[illegible]	2.	2.	2.	2.	3.	3.	3.
[illegible]	[illegible]	[illegible]	5.	5.	6.	[illegible]	7.	7.	8.
[illegible]	[illegible]	[illegible]	9.	10.	10.	10.	10.	10.	10.
11.	11.	11.	11.	11.	11.	[illegible]	13.	14.	[illegible]

[illegible]	[illegible]	[illegible]	27.	[illegible]	[illegible]	34.	[illegible]	38.	40.
[illegible]	44.	46.	48.	49.	[illegible]	[illegible]	[illegible]	56.	[illegible]
[illegible]	[illegible]	[illegible]	64.	[illegible]	[illegible]	71.	73.	75.	77.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	106.	114.
[illegible]	[illegible]	147.	157.	[illegible]	[illegible]	[illegible]	209.	223.	238.
[illegible]	[illegible]	[illegible]	306.	[illegible]	[illegible]	[illegible]	[illegible]	386.	403.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	564.	575.
[illegible]	[illegible]	595.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1737.
[illegible]	[illegible]	1822.	[illegible]	1520.	[illegible]	[illegible]	1089.	[illegible]	358.
[illegible]	[illegible]	820.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	651.	679.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	507.	473.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	251.	240.
[illegible]	219.	209.	[illegible]	191.	[illegible]	175.	170.	[illegible]	161.
[illegible]	[illegible]	[illegible]	144.	141.	[illegible]	[illegible]	139.	[illegible]	124.
[illegible]	[illegible]	115.	[illegible]	[illegible]	[illegible]	108.	106.	[illegible]	103.
[illegible]	[illegible]	[illegible]	97.	[illegible]	[illegible]	[illegible]	91.	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91.	[illegible]	[illegible]	78.
[illegible]	[illegible]	[illegible]	74.	[illegible]	[illegible]	72.	71.	70.	69.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	59.	58.	57.

STORAGE

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	366.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	366.	[illegible]	[illegible]
[illegible]	[illegible]	366.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	367.	367.	[illegible]
[illegible]	367.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	369.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	370.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	371.	[illegible]	371.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	375.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	384.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	393.	[illegible]	[illegible]	393.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	402.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	416.
[illegible]	[illegible]	[illegible]	426.	419.	[illegible]	[illegible]	[illegible]	421.	421.
[illegible]	[illegible]	423.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	431.
[illegible]	[illegible]	437.	[illegible]	440.	[illegible]	[illegible]	[illegible]	447.	449.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	461.	452.	463.
[illegible]	[illegible]	467.	[illegible]	[illegible]	[illegible]	[illegible]	471.	472.	473.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	482.	[illegible]	501.	510.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	496.	493.	491.	488.
[illegible]	[illegible]	[illegible]	[illegible]	481.	[illegible]	[illegible]	478.	477.	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	472.	472.	471.	470.	[illegible]	[illegible]
[illegible]	[illegible]	461.	459.	[illegible]	455.	454.	[illegible]	451.	449.
[illegible]	447.	[illegible]	444.	[illegible]	442.	[illegible]	441.	[illegible]	435.
[illegible]	437.	[illegible]	435.	[illegible]	[illegible]	[illegible]	433.	[illegible]	432.
[illegible]	[illegible]	431.	[illegible]	[illegible]	[illegible]	429.	429.	428.	428.
427.	427.	427.	426.	[illegible]	[illegible]	425.	425.	425.	[illegible]
[illegible]	[illegible]	[illegible]	423.	[illegible]	423.	422.	422.	422.	422.
421.	421.	421.	421.	420.	[illegible]	420.	420.	420.	419.
419.	419.	418.	418.	418.	417.	417.	416.	[illegible]	418.

STAGE

[illegible]	769.0	[illegible]	769.0	[illegible]	[illegible]	[illegible]	769.0	769.0	[illegible]
[illegible]	769.0	[illegible]	[illegible]	769.0	[illegible]	[illegible]	[illegible]	769.0	769.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	769.0	769.0	769.0	769.0
769.0	[illegible]	769.0	769.0	769.0	[illegible]	[illegible]	[illegible]	[illegible]	769.1
769.1	[illegible]	[illegible]	769.1	769.1	[illegible]	769.1	[illegible]	769.1	769.1
[illegible]	769.1	[illegible]	769.1	769.1	[illegible]	769.1	769.1	769.1	769.1
769.1	769.1	769.1	769.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	769.2

[illegible]	[illegible]	769.2	769.2	769.2	769.2	769.2	769.3	769.3	769.3
[illegible]	[illegible]	769.4	769.4	769.4	769.5	769.5	769.5	769.5	769.6
[illegible]	[illegible]	[illegible]	769.7	769.7	769.7	769.7	769.8	769.8	769.8
[illegible]	[illegible]	769.9	[illegible]	769.9	770.0	770.0	770.0	770.0	770.1
[illegible]	[illegible]	[illegible]	[illegible]	770.2	770.2	770.2	770.2	770.3	770.3
[illegible]	[illegible]	[illegible]	[illegible]	770.4	770.4	770.4	770.4	770.4	770.5
[illegible]	[illegible]	770.5	770.	770.5	[illegible]	[illegible]	[illegible]	770.6	[illegible]
[illegible]	[illegible]	770.6	770.6	770.7	770.7	770.7	770.7	770.8	770.8
[illegible]	[illegible]	[illegible]	[illegible]	771.1	771.1	771.2	771.2	771.3	771.3
[illegible]	[illegible]	771.4	[illegible]	771.5	[illegible]	[illegible]	[illegible]	771.5	771.6
[illegible]	771.7	771.7	[illegible]	771.8	[illegible]	[illegible]	[illegible]	[illegible]	771.9
[illegible]	[illegible]	771.9	[illegible]	[illegible]	[illegible]	[illegible]	772.3	772.5	772.7
[illegible]	[illegible]	[illegible]	772.7	772.6	772.5	772.4	772.4	772.3	772.2
[illegible]	[illegible]	772.1	772.1	772.1	772.0	772.0	772.0	772.0	772.0
[illegible]	[illegible]	[illegible]	[illegible]	771.9	771.9	[illegible]	771.8	771.8	771.8
771.7	[illegible]	[illegible]	[illegible]	771.5	[illegible]	771.4	[illegible]	[illegible]	[illegible]
771.3	[illegible]	[illegible]	[illegible]	771.2	[illegible]	771.1	771.1	771.1	771.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.9	770.9
[illegible]	[illegible]	[illegible]	[illegible]	770.9	[illegible]	770.8	[illegible]	[illegible]	770.8
[illegible]	770.7	770.7	[illegible]	770.7	770.7	770.7	770.7	770.7	770.7
770.7	770.7	[illegible]	[illegible]	[illegible]	770.6	[illegible]	770.6	770.6	770.6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.5
770.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	770.5	770.4

PEAK OUTFLOW IS [illegible] AT TIME [illegible] HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	[illegible]	[illegible]	237.	[illegible]	[illegible]
CMS	[illegible]	19.	[illegible]	[illegible]	[illegible]
INCHES		11.32	14.03	14.03	14.03
MM		[illegible]	356.42	[illegible]	[illegible]
AC-FT		[illegible]	411.	411.	411.
THOUS CU M		[illegible]	[illegible]	507.	507.

********** ********** ********** ********** **********

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

[illegible] STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	1001	.55	1	5424.	2912.
		(1.42)	(	144.92)(	82.46)(
[illegible]	10012	.[illegible]	1	4777.	1316.
		([illegible])	(	135.27)(	34.71)(

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	7[illegible].00	769.0	771.00
STORAGE	[illegible]6.	3[illegible].	4[illegible]7.
OUTFLOW	0.	0.	149.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.[illegible]	77[illegible]	2.[illegible]2	[illegible]	4771.	11.67	15.[illegible]2	0.00
.50	772.[illegible]	1.[illegible]7	514.	1916.	7.42	16.00	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT        10019
ROUTE HYDROGRAPH TO         10019
END OF NETWORK
```

```
**********************************
    ...   SURFACE PACKAGE (HEC-1)
       ...             JULY 1978
   LAST MODIFICATION   ...
**********************************

    DATE# ...
    TIME# ...

                         DAM SAFETY INSPECTION ...
                           ... DAM ...
                           ...

                              JOB SPECIFICATION
        NO    NHR    NMIN   IDAY    IHR    IMIN   METRC   IPLT   IPRT   NSTAN
        ...                         0              0       0      -4      0
                                  JOPER   NWT   LROPT   TRACE
                                    5      0     0       0

                        MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1  NRTIO= ...  LRTIO= 1
           RTIOS=   .10     .11     .12     .13     .14    ...

 **********      **********      **********      **********      **********

                        SUB-AREA RUNOFF COMPUTATION

        INPUT RUNOFF PARAMETERS

                  ISTAQ    ICOMP    IECON    ITAPE    JPLT    JPRT    INAME   ISTAGE   IAUTO
                  ...        0        0        0        0      0       1        0        0

                                    HYDROGRAPH DATA
        IHYDG    IUHG    TAREA    SNAP    TRSDA    TRSPC    RATIO    ISNOW    ISAME    LOCAL
          1        2      .55     0.00     .55     1.00    ...                 1         0

                                    PRECIP DATA
              SPFE     PMS      R6      R12      R24      R48      R72      R96
              0.00    24.50   130.00   120.00   130.00    0.00     0.00     0.00

                                    LOSS DATA
        LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
          0      0.00    0.00    1.00    0.00    0.00    1.00   -1.00  -93.00    0.00    0.00

            CURVE NO = -93.00   WETNESS = -1.00   EFFECT CN = 93.00

                              UNIT HYDROGRAPH DATA
                             TC= 0.00    LAG=  .22

                                 RECESSION DATA
                   STRTQ=   0.00    QRCSN=   0.00    RTIOR= 1.00

                              END-OF-PERIOD FLOW
     MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q
```

```
                                                                     SUM  2.37   31.48    489.  134915.
                                                                        ( 822.)( 800.)(  28.)( 3794.88)

  **********        **********        **********        **********        **********

                                    HYDROGRAPH ROUTING

              ROUTE HYDROGRAPH THROUGH PERCY PHILIPS DAM RESERVOIR

                    ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                    1F01       1       0       0       0       0       1       0       0
                                         ROUTING DATA
           QLOSS   CLOSS     AVG   IRES   ISAME    IOPT    IPMP           LSTR
               0   0.000   0.00      1       1       0       0              0

                  NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                      1       0       0   0.000   0.000   0.000  -770.     -1

STAGE     755.00    768.25    769.45    769.67    770.00    770.21    770.84    771.11    771.41    771.68
          771.95    772.38    772.69    772.94    773.51    774.60

FLOW        0.00      1.50      6.40      9.50     11.00     60.00     110.00    173.00    273.00    417.00
          634.00   1000.00   1300.00   1456.00   6100.00  13000.00

SURFACE AREA=     0.        2.        7.       16.       31.       35.       37.       55.       77.      132.

CAPACITY=         0.       7.       46.      179.      366.      390.      759.     1437.      643.     1982.

ELEVATION=      735.     740.      750.      760.      760.      770.      770.      771.      780.      790.

                  CREL   SPWID    COQW    EXPW    ELEVL    COQL   CAREA    EXPL
                  755.     0.0     0.0     0.0     0.0      0.0     0.0     0.0

                                           DAM DATA
                                   TOPEL    COQD    EXPD   DAMWID
                                   771.0     0.0     0.0      0.

PEAK OUTFLOW IS      174. AT TIME  17.33 HOURS

PEAK OUTFLOW IS      124. AT TIME  17.25 HOURS

PEAK OUTFLOW IS      146. AT TIME  17.00 HOURS

PEAK OUTFLOW IS      180. AT TIME  16.58 HOURS

PEAK OUTFLOW IS      198. AT TIME  16.42 HOURS

PEAK OUTFLOW IS      220. AT TIME  15.33 HOURS
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .10	RATIO 2 .11	RATIO 3 .12	RATIO 4 .13	RATIO 5 .14	RATIO 6 .15
				RATIOS APPLIED TO FLOWS					
HYDROGRAPH AT	1001	.55	1	587.	6[illegible].	6[illegible].	7[illegible]7.	[illegible].	874.
	(	1.42)	(	16.6[illegible])(	18.19)(	19.79)(	21.[illegible])(	[illegible].0[illegible])(	24.74)(
ROUTED TO	1001	.55	1	104.	124.	146.	1[illegible].	198.	230.
	(	1.42)	(	2.94)(	3.5[illegible])(	4.13)(	[illegible].76)(	5.62)(	6.51)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	7[illegible].00	769.00	771.00
STORAGE	366.	366.	437.
OUTFLOW	0.	0.	[illegible]49[illegible]

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.1[illegible]	770.77	0.00	42[illegible].	1[illegible].	0.00	17.33	0.00
.1[illegible]	770.[illegible]	0.00	43[illegible].	1[illegible].	[illegible]	17.25	0.00
.1[illegible]	770.98	0.00	43[illegible].	[illegible]	0.[illegible]0	17.0[illegible]	0.00
.1[illegible]	771.[illegible]	.05	44[illegible].	[illegible]	[illegible]	16.5[illegible]	0.00
.14	771.1[illegible]	.1[illegible]	444.	[illegible]	[illegible]	16.42	0.00
.15	771.2[illegible]	.2[illegible]	446.	[illegible]	2.[illegible]	16.35	0.00

HEC-2 INPUT AND SUMMARY TABLE

```
*****************************************************
 HEC1 RELEASE DATED NOV 76 UPDATED JULY 1978
 ERROR CORR - [illegible]
 MODIFICATION - [illegible]
*****************************************************

T1    DAM SAFETY INSPECTION
T2    PERRY PHILLIPS DAM
T3    SPILLWAY RATING CURVE

J1  ISNOCK    IDG    MINV     IDIR     ISTRT    METRIC    HVINS     Q          ELEV      FQ
       0.       0.       0.       0.  -1.00000   0.00      0.0       0.    760.000    0.000
J1  NORCE    IPLOT   PREVS    XSELV    KSECO     FN       ALLEC     TAW     CHVIM     ITRACE
    1.000    .000   -1.000    0.000    0.000    0.000     0.000    0.000    0.000     0.000
J3  VARIABLE CODE FOR SUMMARY PRINTOUT
   46.000    .000   2500.0    4.000    76.000   19.000   42.000    3.00     0.000    17.000
J5  LPRNT   NUMSEC            *********END OF SECTION NUMBERS*********
  -10.000  -10.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000
NC    .030     .030     .030     0.000    0.000    0.000    0.000    0.000    0.000    0.000
ET  11.000   10.000   100.000  155.000  232.000  310.000  [illegible]  150.000  700.000  1000.000
GT 1300.000 1700.000   0.000    0.000    0.000    0.000    0.000    0.000    .000     1.000

X1   1.000    4.000    0.000    54.000   0.000    0.000    0.000    0.000    0.000    0.000
   772.000    0.000  763.750   12.000  769.750  [illegible]  771.000  [illegible]  0.000  0.000

X1   2.000    4.000    0.000    0.000   46.000   46.000    [illegible]  0.000  0.000    0.000
EJ   0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000    0.000
```

....

[illegible] RELEASE DATED [illegible] UPDATED JULY 1979
ERROR CORR - [illegible]
MODIFICATION - [illegible]

....

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

SPILLWAY RATING CURVE

SUMMARY PRINTOUT

	SECNO	DEPTH	AREA	[illegible]	VCH	HV	Q	EC	10*KS	K*XNCH
*	1.000	[illegible]	14.93	42.42	[illegible]	.17	[illegible]	770.39	186.66	30.00
*	1.000	[illegible]	24.27	46.[illegible]	4.12	[illegible]	1[illegible]	77[illegible].63	165.47	[illegible]
*	1.000	.77	3[illegible]	[illegible]	4.6[illegible]	.34	155.[illegible]	770.46	15[illegible]	30.00
*	1.000	[illegible]	44.36	[illegible]	5.16	.42	23[illegible]	771.15	142.17	30.00
*	1.000	1.[illegible]	5[illegible]	7.36	[illegible]	[illegible]	[illegible]	771.42	134.[illegible]	30.[illegible]
*	1.000	1.[illegible]	[illegible].17	57.1[illegible]	6.[illegible]	.57	400.00	771.69	129.15	[illegible].00
*	1.000	1.44	82.49	[illegible]	[illegible]	.69	550.00	77[illegible]	121.67	30.00
*	1.000	1.47	102.35	2.26	7.[illegible]	.83	750.[illegible]	77[illegible]	11[illegible]	[illegible]
*	1.000	[illegible]	12[illegible]	[illegible]	7.99	.99	1[illegible]	773.07	10[illegible]	30.0[illegible]
*	1.000	[illegible]	1[illegible].01	64.66	[illegible]	1.[illegible]	1300.00	773.[illegible]	104.57	30.00
*	1.000	3.16	178.23	64.00	[illegible]	1.41	1700.00	774.32	100.66	30.00
	2.000	.72	3[illegible].72	[illegible].02	1.[illegible]	.0[illegible]	50.00	770.91	20.17	30.00
	2.000	1.01	45.73	[illegible].26	2.1[illegible]	.07	1[illegible]	770.99	24.[illegible]6	30.00
	2.000	1.26	[illegible].03	58.51	[illegible]	.11	155.00	771.11	27.[illegible]7	30.00
	2.000	1.[illegible]	7[illegible].84	59.[illegible]	[illegible]	.15	230.00	771.[illegible]	29.27	30.00
	2.000	1.7[illegible]	89.52	61.[illegible]	[illegible]	.19	31[illegible].00	771.[illegible]	30.95	30.00
	2.000	1.97	102.2[illegible]	62.25	3.[illegible]	.24	400.00	771.96	3[illegible].[illegible]7	30.00
	2.000	2.[illegible]	123.17	63.[illegible]	4.47	.31	55[illegible].0[illegible]	772.3[illegible]	34.87	30.00
	2.000	2.47	14[illegible].32	64.00	[illegible]	.40	750.00	77[illegible].82	36.26	30.00
	2.000	3.[illegible]	173.74	64.00	[illegible].76	.51	1000.00	77[illegible]	37.[illegible]	30.00
	2.000	3.[illegible]	201.[illegible]6	64.00	[illegible].47	.65	1300.00	773.91	39.94	30.00
	2.000	4.[illegible]	23[illegible].50	64.00	7.25	.82	1700.00	774.60	41.75	30.00

SUMMARY OF ERRORS

CAUTION SECNO= 1.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 9 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 11 CRITICAL DEPTH ASSUMED


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